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Forty-fourth Annual Report

OF

The Connecticut Agricultural Experiment Station

Being the annual report for the year ended October 31

1920

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Press of
The Wilson H. Lee Company

CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

OFFICERS AND STAFF

October 31, 1920.

BOARD OF CONTROL.

His Excellency, Marcus H. Holcomb, *ex-officio*, *President*.

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Administration.	E. H. Jenkins, Ph.D., *Director and Treasurer.* Miss V. E. Cole, *Librarian and Stenographer.* Miss L. M. Brautlecht, *Bookkeeper and Stenographer.* William Veitch, *In charge of Buildings and Grounds.*
Chemistry.	
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Protein Research.	T. B. Osborne, Ph.D., D.Sc., *Chemist in Charge.*
Botany.	G. P. Clinton, Sc.D., *Botanist.* E. M. Stoddard, B.S., *Assistant Botanist.* Miss Florence A. McCormick, Ph.D., *Scientific Assistant.* G. E. Graham, *General Assistant.* Mrs. L. D. Kelsey, *Stenographer.*
Entomology.	W. E. Britton, Ph.D., *Entomologist; State Entomologist.* B. H. Walden, B.Agr., John T. Ashworth, M. P. Zappe, B.S., Philip Garman, Ph.D., *Assistant Entomologists.* Samuel T. Sealy, *Deputy in Charge of Mosquito Control.* Miss Gladys M. Finley, *Stenographer.*
Forestry.	Walter O. Filley, *Forester, also State Forester and State Forest Fire Warden.* A. E. Moss, M.F., *Assistant State and Station Forester.* H. W. Hicock, M.F., *Assistant Forester.* Miss Pauline A. Merchant, *Stenographer.*
Plant Breeding.	Donald F. Jones, S.D., *Plant Breeder.* C. D. Hubbell, *Assistant.*
Vegetable Growing.	————————

Report of the Board of Control

OF

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

To His Excellency, Marcus H. Holcomb, Governor of Connecticut:

As required by law, the Board of Control of the Connecticut Agricultural Experiment Station herewith respectfully presents its report for the year ending October 31, 1920.

Changes in the Station Staff.

Miss Etta L. Avery, who had rendered efficient service for nine years as stenographer in the forestry department, died on March 8, 1920.

Michael D'Esopo, assistant chemist, resigned December 1, 1919, to accept an engagement elsewhere.

To fill vacancies in the staff of the chemical department, R. E. Andrew, M.A., began his duties on November 10, 1919, and Owen Nolan on April 1, 1920.

John T. Ashworth succeeded I. W. Davis as deputy in charge of gipsy moth work, on June 1, 1920.

K. F. Chamberlain, assistant in entomology, resigned March 1, 1920.

Samuel T. Sealy was appointed deputy in charge of mosquito work in April of this year.

W. C. Pelton, in charge of vegetable work, resigned May 1, 1920, to accept an assistant professorship in Pennsylvania State College.

A brief summary of the work of the year follows:

The Botanical Department.

Dr. Clinton in Charge.

An extensive study of the life history of the rusts, Petrie dish infections with rusts, as well as a special study of the pine blister rust, are being carried on by Dr. Clinton with the assistance of Miss McCormick.

Dr. Clinton also continues his study of peach yellows.

During the year a disease survey of tobacco has been prosecuted in coöperation with the Extension Department of the Conn. Agricultural College and the Hartford County Farm Bureau; and for the purpose a temporary summer laboratory for the Station's use was established through the courtesy of the Hartford County Farm Bureau at its headquarters in Hartford. A report of this survey has been prepared.

Special studies of the black rot of tobacco (*Thielavia*) are being carried on by Miss McCormick.

In the field, an experiment on the merits of spraying *versus* dusting for control of the insects and fungi attacking apples has been carried on by Mr. Stoddard of this department, in coöperation with the entomologist.

Other spraying tests on apples and peaches have been conducted by Dr. Clinton and Mr. Stoddard.

The tests of the effect of different fertilizers on the prevalence of fungus troubles are continued.

Work on the improvement of the quality of sweet corn seed by the prevention of disease and by improvement in curing has been carried on under the supervision of Mr. Stoddard.

Four hundred and sixty-three samples of field and garden seeds have been tested for farmers and dealers, chiefly by Mr. Graham. Several hundred samples of sweet corn seed have also been tested in the course of our experiments.

The special publications of the department have been: Report of the Botanist, Bulletin 222, of 86 pp. and 24 plates; Treatment of Apple Trees Girdled by Mice, by E. M. Stoddard, Bulletin of Immediate Information No. 10, 8 pp.

The Chemical Department.

Dr. Bailey in Charge.

Some time has been given to the study of improved methods, especially for the determination of caffein. But the larger share of the time of this department has been taken up with the work of chemical analysis. The testing of samples for the Dairy and Food Commissioner has required much more work than ever before.

Seven hundred and sixty-four samples of fodder materials and field crops, over six hundred samples of fertilizers, and about twenty-four hundred samples of foods, drugs and miscellaneous articles have been analyzed and the results prepared for publication—the latter a matter involving much labor. Twenty-four hundred and sixty-two pieces of Babcock glassware have been tested and either certified correct or rejected. About two per cent. were found to be inaccurate.

Expert testimony in court has been required in 16 cases. The department has coöperated with the Police and Health authorities in a number of other cases, notably in Hartford in December, 1919, which was the first of a series of prosecutions growing out of the distribution, sale and consumption of liquor containing wood alcohol, by which many persons were poisoned.

This department has issued the annual report on Fertilizers, Bulletin 217; annual report on Food Products and Drugs, Part 1, Bulletin 219; Part 2 (Diabetic Foods), Bulletin 220; annual report on Feeding Stuffs, Bulletin 221.

Dr. Bailey continues as Expert on Diabetic Foods for the American Medical Association, a referee of the Association of Official Agricultural Chemists, and State Chemist.

The Entomological Department.

Dr. Britton in Charge.

On account of the Federal quarantine, the importation of foreign nursery stock has greatly decreased, only seventeen shipments requiring the entomologist's inspection, of which eleven were infested with insects or fungi.

Ninety-five nurseries were officially inspected and sixty-five orchards and gardens examined.

Four hundred and eighty apiaries, containing about 2,250 colonies, were also inspected, to eliminate foul brood.

In coöperation with the Federal Bureau of Entomology the work of controlling the gipsy moth has been actively prosecuted. The number of infestations found and the number of egg clusters destroyed have been about the same as last year. For this department a new automobile truck power sprayer and two new Ford trucks have been purchased. A Ford touring car has also been acquired by exchange.

An experiment on the efficiency of dusting compared with spraying to control insects and fungi has been carried out in the apple orchard of Mr. W. F. Platt in Milford. About 116 large trees were included and all the fruit from certain trees in each plot was examined and scored.

Spraying tests to control the potato aphid have also been completed.

Mr. Zappe has studied the life history of a new species of sawfly on Austrian pine and has made preliminary studies of the hatching and development of the apple red bug and apple leaf-hopper.

Dr. Garman has studied the life history of the bulb mite and measures of control, and the results are now ready to publish. He has found in six widely separated Connecticut orchards the European plum mite, a species not hitherto known to occur in this country, but since reported in New Jersey and Pennsylvania. The damage done by it is more severe and becomes apparent earlier in the season than that of other orchard mites. Spraying and dusting tests indicate that summer treatment is nearly futile, but where commercial lime-sulphur was used as a dormant spray the injury was much less severe.

Dr. Garman is also studying the life history of the spittle insects attacking grasses, and is also preparing two papers for the Natural History Survey of the State, one on the Dragon Flies, and the other on the Mites of Connecticut.

Mr. Walden has collected an important series of leaf-hoppers from different host plants.

Dr. Britton has nearly completed the preparation and editing of a paper of one thousand pages on the Hemiptera of Connecticut, for the Natural History Survey. Fifteen specialists have coöperated in its preparation. The check list of Connecticut insects, by the Entomologist, is now being printed as Bulletin 31 of the Survey.

This department has prepared Bulletin 216 on Insects Attacking Squash, Cucumber and Allied Plants in Connecticut, and the Annual Report of the State and Station Entomologist, Bulletin 218.

Mosquito Elimination.

S. T. Sealy in Charge.

This work, required by statute, is closely related to that of the entomologist, under whose general supervision it has been carried on for a term of years. This year Mr. Sealy has been in direct charge of it.

A constant patrol has been maintained on all the drained salt marsh in Fairfield, Orange, New Haven, East Haven, Branford, Guilford and Madison, the total area of drained marsh being 5,000 acres. Supplementary ditches have been made where necessary and the outlets to the sea reopened when blocked with sand thrown up by storms.

At no time have any considerable broods of mosquitoes developed on the drained marshes. The trouble has mainly come from neighboring marshes which are not ditched, and from the "rain barrel" mosquitoes, which breed in stagnant fresh water about houses and inland pools.

The only new ditching this year has been a tract of 60 acres at Groton Long Point.

The Forestry Department.

Mr. Filley in Charge.

Owing to labor shortage, forest plantings were greatly reduced this year, only 11,700 trees being set on the State and Station forest areas. Eleven examinations of forest land have been made for the owners, to advise as to management and planting.

Blister Rust Work.

The blister rust control work has been carried on by this department under the direct supervision of Mr. Hicock, the botanical department coöperating in studies on the nature and method of spread of the disease. An eradication camp was established in Colebrook, and during July and August more than 2,000 acres were freed from currant and gooseberry plants in an area east

of that worked in previous years in Norfolk. Over 80 per cent. of this is forest land and contains much pine reproduction as well as some old timber. Some pine blister rust infection was found. Mr. Hicock scouted the northwestern corner of the State, finding no new pine infection centers, but the *ribes* infection is general throughout Litchfield county. Careful examination indicates that in the eradication area no pine infections have occurred since 1916 when the work was begun.

Work by State Park Commissioner.

The assistant forester, Mr. Moss, was employed by the State Park Commission from July to December, 1919, in gathering data for a topographic and type map of Macedonia State Park, a tract of 2,000 acres, chiefly woodland, in the town Kent.

State Forests.

As State Forester, Mr. Filley has added 408 acres to the Eastford State Forest, making the total area of State Forests 4,267 acres.

About $2,500 was received for ties, poles and cord wood, and 10,000 pines were set on the cut-over land.

State Forest Fire Warden.

As State Forest Fire Warden, Mr. Filley reports that, because of weather conditions, much less damage by forest fires has been done this year than is usual.

In 1919 there were 720 forest fires, but only 39 of these occurred after October 1st, and during the first six months of the present year, only 349. The property damage in 1919 was $78,000, and for the first six months of 1920, only $35,000. This decrease is almost entirely due to weather conditions, as the fire warden service has been greatly handicapped by labor cost.

Tree Protection Examining Board.

The botanist, entomologist and forester of this Station are a board required by law to examine commercial tree workers as to their fitness for improving trees by pruning, filling, spraying, etc. The forester is secretary of this board. In the 12 months ending June 30, 1920, 59 applicants were examined and 55 certificates issued. Three certificates were refused. From July 1, 1920, to September 30, 1920, one new certificate was issued and thirty-four certificates were renewed. It has been necessary to examine the work of some applicants before issuing certificates and to investigate a few complaints. No certificates have been revoked because of improper method.

The Department of Market Gardening.

Mr. Pelton in Charge.

A study of the Hahto Soy Bean, edible in its green state and a possible substitute for lima beans, was begun and material gathered for improvement by selection. Tests of seedmen's varieties and strains of onions, string beans, carrots and beets bearing on the standardization of crops, and comparisons of yield and quality of strains of other vegetables were begun and carried through one season. Studies on the soil of the Wallingford plain were also undertaken.

It was with great regret that this work, which promised to be very useful, had to be dropped soon after it was well under way.

Mr. Pelton resigned in May, 1920, to accept a position in another institution, and a successor was not appointed as it was evident that it could not be done with the funds at the disposal of the Station but only by creating a deficit.

Researches Supported by the Adams Fund.

Dr. Osborne and Dr. Jones in Charge.

It is required by Federal authorities, who control the payments from this fund, that it shall be entirely spent in research on subjects approved by the Office of Experiment Stations and preferably on projects continued through a term of years.

One of these projects in charge of Dr. Osborne is a study of the different protein bodies found in food products and of their relative value in nutrition.

The current work under this project consists of elaborate studies of the proteins of the green leaves, a subject which has hitherto not been investigated to any considerable extent, and which the agricultural importance of these food stuffs seems to render most timely.

By methods which Dr. Osborne has developed, it has become possible to isolate and purify the proteins of green, actively growing plants, either before or after drying, in spite of the special difficulties which such work presents.

It will therefore be possible to subject these proteins to the same rigid study which the proteins of the seeds and grains have already received in this laboratory.

The publications of this department are listed on a following page.

In the field of nutrition investigations a study is being made of the quantitative and qualitative aspects of vitamine problems which have been raised by the experience gained in the Station work during the past few years; likewise a study of the role of fats *per se* in the ration.

The second project on problems of inheritance is in charge of Dr. Jones.

A new tobacco, "Connecticut Round Tip," being a combination of Sumatra with broad leaf, which has been established by years of selection, has been tested by thirteen growers, in amounts ranging from one-half acre to eight acres. Its superiority to Connecticut Havana is in shape of leaf, somewhat larger growth, greater number of leaves, and better resistance to adverse soil conditions. Competent judges consider it a most promising variety which deserves further careful trial.

A hybrid type of corn derived from inbred strains by a process called "double crossing," has been grown in some twenty different parts of the State.

The corn variety testing work, in coöperation with the Storrs Station, is being continued until all the promising varieties so far located have been grown at least three years.

The investigations dealing with the process of heredity in corn and tobacco are being continued.

The publications of this department are listed on a following page.

Library and Collections.

The Station library now numbers something over 5,300 bound volumes insured for $20,000. The botanical collection numbers over 48,000 specimens, and the entomological collection over 20,800 specimens of which 5,300 are determined and arranged systematically.

Publications.

During the year the Station has issued the annual report for 1919, consisting of Bulletins 215 to 222, and Bulletins of Immediate Information, Nos. 10 and 11, aggregating in all 487 pages, with 60 full page plates.

A considerable part of the research work of the Station cannot be printed in its bulletins, partly because space is lacking, and partly because the subject matter is not of immediate practical value to farmers, to whom the larger part of our editions is sent.

Following is a list of papers written by members of the Staff and published elsewhere than in Station publications:

By T. B. Osborne and others in his Department:

Do Fruits Contain Water-Soluble Vitamine? Thomas B. Osborne and Lafayette B. Mendel. Proc. Soc. Exper. Biol. and Med. (1919) XVII, 46-47.

Extraction and Concentration of the Water-Soluble Vitamine from Brewer's Yeast. Thomas B. Osborne and Alfred J. Wakeman. Jour. Biol. Chem. (1919) XL, 383-394.

Nutritive Value of the Proteins of the Barley, Oat, Rye and Wheat Kernels. Thomas B. Osborne and Lafayette B. Mendel. Jour. Biol. Chem. (1920) XLI, 275-306.
Nutritive Factors in Plant Tissues. III. Further Observation on the Distribution of Water-Soluble Vitamine. Thomas B. Osborne and Lafayette B. Mendel. Jour. Biol. Chem. (1920) XLI, 451-468.
Fat-Soluble Vitamine of Green Foods. Thomas B. Osborne and Lafayette B. Mendel. Proc. Am. Soc. Biol. Chem., Jour. Biol. Chem. (1920) XLI, p. vii.
Nutritive Factors in Plant Tissues. IV. Fat-Soluble Vitamine. Thomas B. Osborne and Lafayette B. Mendel. Jour. Biol. Chem. (1920) XLI, 549-565.
Milk as a Source of Water-Soluble Vitamine. II. Thomas B. Osborne and Lafayette B. Mendel. Jour. Biol. Chem. (1920) XLI, 515-523.
The Proteins of Green Leaves. I. Spinach Leaves. Thomas B. Osborne and Alfred J. Wakeman. Jour. Biol. Chem. (1920) XLII, 1-26.
The Water-Soluble Vitamine. Thomas B. Osborne. N. Y. State Jour. Med. (1920) XX, 217-222.
The Occurrence of Water-Soluble Vitamine in Some Common Fruits. Thomas B. Osborne and Lafayette B. Mendel. Jour. Biol. Chem. (1920) XLII, 465-489.
Does Gliadin Contain Amide Nitrogen? Thomas B. Osborne and Owen L. Nolan. Jour. Biol. Chem. (1920) XLIII, 311-316.
Nutrition Experiments with Rats. A Description of Methods and Technic. Edna L. Ferry. Jour. Lab. and Clin. Med. (1920) V, 735-745.

By D. F. Jones.

Teas' Hybrid Catalpa. D. F. Jones and W. O. Filley. Jour. Heredity (1920) **11**: 1-9.
A Paraffine Ruler for Drawing Curves. D. F. Jones. Science, N. S. (1920) **51**: 245.
Selection in Self-Fertilized Lines as the Basis for Corn Improvement. D. F. Jones. Jour. Amer. Soc. Agron. (1920) **12**: 77-100.
Heritable Characters in Maize. IV. A Lethal Seed Factor.—Defective Seeds. D. F. Jones. Jour. Heredity (1920) **11**, 161-167.
Selective Fertilization in Pollen Mixtures. D. F. Jones. Biological Bulletin (1920) **38**: 251-289. Abstract in Proc. Nat. Acad. Science (1920) **6**: 66-70.

By G. P. Clinton and Florence McCormick.

Artificial Infection of Pine with *Cronartium ribicola*. Amer. Plant Pest Committee, Bull. 4.

By G. P. Clinton.

Biographical Notice of Prof. W. G. Farlow. Phytopathology (1920) X, 1-7.

By W. E. Britton.

Some Phases of Beekeeping in Connecticut. Jour. of Econ. Entomology (1920) **13**: p. 91.
A Connecticut Corn Field Injured by *Crombus præfectellus*, Zinck. Jour. of Econ. Entomology (1920) **13**: p. 222.
More about the Cyclamen Mite. Florists' Exchange (1920) XLIX, p. 285.

The following statistical summary includes some features not referred to earlier in this report:

Number of letters written	9,603
Fertilizers analyzed	600
Feeds analyzed	764
Foods and Drugs analyzed	2,400
Babcock apparatus tested	2,462
Nurseries, orchards and gardens inspected	160
Imported nursery stock inspected (cases)	87
Apiaries inspected	480
Specimens identified for applicants	406
Papers published in scientific journals	19
Addresses delivered	61

The Present Condition and Needs of the Station.

The salaries paid by this Station have been lower than those paid for corresponding ability and experience in other agricultural institutions, and, in consequence, within the last biennial period valued members of the Station Staff have resigned to accept more adequate salaries elsewhere.

The increased cost of all materials and of labor has also added to the difficulties which have confronted this and all other stations.

Owing to an unprecedented increase in the work required for the dairy and food commissioner, the appropriation of $2,500 per year for the work was so grossly inadequate that the State Board of Control granted $2,500 to meet the emergency.

With this aid and by the utmost economy, involving the suspension of the department of vegetable growing, the Station has avoided a deficit, the treasurer's account showing a balance of $13.45 at the end of the fiscal year.

But to keep within the present appropriation has involved loss of efficiency, which if continued, must, we feel, result in serious injury to agricultural interests. The work of the agricultural station is fundamental. It forms the basis of the teaching of the Agricultural College and Extension Department. Like all fundamental work, it is not in the public eye, it cannot be exploited in print, and its help to agriculture is not generally and justly appreciated and valued.

But it is certain that if the investigation and experiment carried on at the Station lose in character and amount, there will be corresponding loss in the character of the teaching and practice of agriculture.

We shall therefore ask the next General Assembly for a considerable increase of the appropriation hitherto made to this Station.

All of which is respectfully submitted.

George A. Hopson,
Secretary.

New Haven, Connecticut, October 31, 1920.

REPORT OF THE TREASURER.

July 1, 1919–June 30, 1920.

E. H. Jenkins, in account with The Connecticut Agricultural Experiment Station for the fiscal year ending June 30, 1920.

Receipts.

Balance on hand, July 1, 1919 (Analysis Fees)		$9.76
State Appropriation, General	$22,500.00	
State Appropriation, Food	2,500.00	
State Appropriation, Food Deficiency	2,500.00	
State Appropriation, Insect Pest	7,500.00	
United States Appropriation, Hatch	7,500.00	
United States Appropriation, Adams	7,500.00	
Fertilizer Analysis	10,019.33	
Connecticut Agricultural College (for A. E. Moss)	1,250.00	
Connecticut State Department of Health (rent)	200.00	
State Park Commission (for A. E. Moss)	500.00	
New Laboratory Appropriation (for moving greenhouses)	511.77	
Mosquito Elimination Appropriation (for automobile)	650.00	
Sale of Gasoline and Oil	336.58	
Interest on Bank Deposits	99.49	
Miscellaneous	69.32	
Lockwood Trust Income (including sale of tree seedlings and wood and Mt. Carmel Farm produce, $2,483.54)	11,483.54	
		75,120.03
		$75,129.79

Disbursements.

E. H. Jenkins, director, salary		$2,800.00
E. H. Jenkins, treasurer,	"	400.00
V. E. Cole,	"	1,300.00
L. M. Brautlecht,	"	900.00
J. P. Street,	"	216.67
T. B. Osborne,	"	3,000.00
E. M. Bailey,	"	2,766.67
C. B. Morison,	"	574.74
C. E. Shepard	"	1,700.00
W. E. Britton,	"	2,783.34
G. P. Clinton,	"	2,783.34
E. M. Stoddard,	"	1,581.25
W. O. Filley,	"	2,775.00
A. E. Moss,	"	2,250.00
E. L. Ferry,	"	399.99
D. F. Jones,	"	2,683.33
Michael D'Esopo,	"	462.49
Florence McCormick,	"	816.66
W. C. Pelton,	"	1,741.67
H. D. Edmond,	"	1,200.00
R. E. Andrew,	"	1,540.00
V. L. Churchill,	"	1,200.00
Wm. Veitch,	"	894.58
Etta L. Avery,	"	366.67

C. D. Hubbell, salary	$ 880.00	
G. E. Graham, "	1,133.33	
Alta H. Moss, "	555.00	
H. W. Hicock, "	250.00	
L. J. Treadwell, "	245.00	
Owen Nolan, "	360.00	
P. A. Merchant, "	133.33	
Mrs. L. D. Kelsey, "	572.00	
Henry Kiley	1,115.00	
O. J. Welch	1,115.00	
Herbert Edwards	286.67	
Leonal Hand	813.33	
T. F. Barrows	605.00	
Frank Sheldon	1,040.00	
Richard Merwin	394.00	
Ervin Applegate	554.00	
Labor	3,317.96	
Publications	398.37	
Postage	226.90	
Stationery	585.13	
Telephone and Telegraph	223.07	
Freight and Express	99.97	
Gas, Electricity and Kerosene	1,009.23	
Coal	1,984.32	
Water	132.45	
Chemicals	545.50	
Laboratory Supplies	377.36	
Seeds, Plants, etc	247.90	
Agricultural and Horticultural Supplies	155.28	
Food Samples	25.85	
Ice	106.30	
Photographic Supplies	125.15	
Automobile Oil	25.77	
Miscellaneous Supplies	632.47	
Fertilizers	1,009.46	
Feeding Stuffs	524.49	
Library (Books and Periodicals)	477.49	
Library (Binding)	88.00	
Tools, Machinery and Appliances	2,145.43	
Tools, Machinery and Appliances (Repairs)	640.11	
Furniture and Fixtures	122.90	
Furniture and Fixtures (Repairs)	40.30	
Scientific Apparatus	4.75	
Scientific Apparatus (Repairs)	37.29	
Live Stock	16.50	
Traveling by the Board	146.33	
Traveling by the Staff	1,053.66	
Gasoline for Automobiles	673.12	
Travel in connection with Adams Fund Investigations	103.26	
Insurance	1,437.34	
Insect Pest Appropriation to State Entomologist	7,500.00	
Contingent	308.47	
Buildings and Land (Betterments)	68.28	
Buildings and Land (Repairs)	1,218.25	
Buildings and Land (Grounds)	93.87	
Total Disbursements		$75,116.34
Balance on hand, June 30, 1920 (Analysis Fees)		13.45
		$75,129.79

New Haven, Conn., Sept. 28, 1920.

This is to Certify that we have audited the accounts of E. H. Jenkins, Treasurer of the Conn. Agricultural Experiment Station for the fiscal year ending June 30, 1920, and have found them correct.

William P. Bailey,
Lewis W. Phelps,
Auditors of Public Accounts.

Connecticut
Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 223 **OCTOBER, 1920**

Fertilizer Report for 1920

By E. H. JENKINS, *Director, and*
E. MONROE BAILEY, *Chemist in Charge of the Analytical Laboratory.*

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the editions permit.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

OFFICERS AND STAFF

October 31, 1920.

BOARD OF CONTROL.

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Press of
The Wilson H. Lee Company

Report on Commercial Fertilizers, 1920.

By E. H. Jenkins, *Director, and* E. M. Bailey,
Chemist in Charge of the Analytical Laboratory.

In 1920, sixty-seven individuals and firms registered for sale in this State 502 brands of commercial fertilizers, classified as follows:

Nitrogenous superphosphates	364
Cotton seed meal and castor pomace	103
Other chemicals and unmixed materials	41
	508

The law requires that a list of the registered brands shall be published annually.

The following is such a list of all brands of fertilizers registered for sale in this State between January 1 and December 31, 1920.

Brands Registered for the Fiscal Year Ending Dec. 31, 1920.

Alpha Portland Cement Co., Easton, Pa.
Alpha Potash-Lime Fertilizer

American Ag'l Chemical Co., 2 Rector St., New York City
14% Acid Phosphate
16% Acid Phosphate
Ammoniated Fertilizer A
Ammoniated Fertilizer AA
Ammoniated Fertilizer AAA
Ammoniated Fertilizer AAAA
Ammoniated Fertilizer VX
Basic Lime Phosphate
Bone-Phosphate and Potash
Castor Pomace
Cereal and Root Fertilizer
Double A Tobacco Fertilizer
Dry Ground Fish
Fine Ground Bone
Fish and Potash
Five Eight Fertilizer
Grass and Lawn Top Dressing
Grass and Oats Fertilizer
High Grade Acid Phosphate
High Grade Ground Bone
Monarch Potato Manure
Nitrate of Soda
Pulverized Sheep Manure
Special Vegetable Fertilizer
Sure Growth Phosphate Revised

Tobacco Special
Universal Phosphate
Bradley's Alkaline Bone with Potash
Bradley's B. D. Guano
Bradley's Corn Phosphate
Bradley's Half Century Fertilizer Revised
Bradley's New Method Fertilizer
Bradley's Patent Superphosphate Revised
Bradley's Potato Fertilizer
Bradley's Potato Manure
Bradley's Root Crop Manure
Bradley's Special Bay State
Bradleys Special Corn Phosphate without Potash
Bradley's Special Potato Fertilizer without Potash
Bradley's Special Potato Manure without Potash
Bradley's Unicorn
Bradley's Valley Tobacco Fertilizer
Bradley's X L Superphosphate of Lime
E. I. Black Hawk Potato and Truck Fertilizer
E. I. Corn King Revised
E. I. Economizer Phosphate
E. I. Mayflower
E. I. Tobacco Fertilizer
E. I. Unexcelled Fertilizer Revised
G. E. General
G. E. Northern Corn Special 1920
G. E. Potato Manure 1920
Packers' Union Animal Corn Fertilizer
Packers' Union Potato Manure 1920
Packers' Union Universal Fertilizer 1920
Quin. Ammoniated Dissolved Phosphate
Quin. Climax Phosphate
Quin. Corn Manure
Quin. Phosphate
Quin. Potato Phosphate
Quin. Potato Manure
Quin. Spl. Corn Manure without Potash
Quin. Spl. Potato Phosphate without Potash
Quin. Wrapper Leaf Brand Tobacco Manure Revised
Wheeler's Corn Fertilizer
Wheeler's Cuban Tobacco Grower
Wheeler's Potato Manure 1920
Williams & Clark's Americus Ammoniated Bone Superphosphate
Williams & Clark's Americus H. G. Spl. Revised
Williams & Clark's Americus Corn Phosphate
Williams & Clark's Americus Potato Manure
Williams & Clark's Matchless Fertilizer
Williams & Clark's Meadow Queen Fertilizer
Williams & Clark's Potato Phosphate
Williams & Clark's Prolific Fertilizer
Williams & Clark's Seed Leaf Tobacco Manure Revised
Williams & Clark's Spl. Americus Corn Phosphate without Potash
Williams & Clark's Spl. Americus Potato Manure without Potash

American Nitro-Phospho *Corporation*, 80 Lafayette St., New York City
Phosphogerm (Inoculated Organic)

Apothecaries Hall Co., Waterbury, Conn.
Acid Phosphate
Castor Pomace
Consolidated Rendering Co.'s Steamed Bone

Fish
Liberty Corn, Fruit and All Crops
Liberty Market Gardeners' Special
Liberty Market Gardeners' Special (Potash)
Liberty Potato and Vegetable Special
Liberty Sheep Manure
Liberty Tobacco Special
Liberty Tobacco Special (Potash)
Liberty Top Dresser for Grass and Grain
Nitrate of Soda
Raw Ground Phosphate Rock
Tankage

Armour Fertilizer Works, 305 Broadway, New York City.
Armour's Acid Phosphate Fertilizer
Armour's Bone Meal
Armour's Cereal Special No. 1 Fertilizer
Armour's Cereal Special No. 2 Fertilizer
Armour's Cereal Special No. 3 Fertilizer
Armour's Complete Potato Fertilizer
Armour's Crop Grower
Armour's 4-10-0 Fertilizer
Armour's 4-8-5 Fertilizer
Armour's Gardeners' Choice Fertilizer
Armour's General Crop Fertilizer
Armour's Grain Grower Fertilizer
Armour's Nitrate of Soda
Armour's Potato, Onion and Vegetable Fertilizer
Armour's Sheep Manure
Armour's Spl. Tobacco Grower No. 2 Fertilizer
Armour's Super-Grade Potato Mixture Fertilizer
Armour's Tobacco Special Fertilizer
Armour's Tobacco Special Fertilizer (5-4-3)
Armour's Wheat and Clover Fertilizer
Bidwell's Formula

Ashcraft-Wilkinson Company, Candler Building, Atlanta, Ga.
Paramount Brand Good Cotton Seed Meal

Atlantic Packing Co., New Haven, Conn.
Atlantic Fine Bone Meal
Atlantic Grain Fertilizer
Atlantic Potato Phosphate
Atlantic Special Vegetable
Atlantic 3-8-3
Atlantic Tobacco Grower
Atlantic Tobacco Special
Atlantic 2-8
Atlantic 2-8-3
Atlantic 4-8
Dry Ground Fish
Ground Tankage
Nitrate of Soda

Baker Castor Oil Co., 120 Broadway, New York City.
Castor Pomace

Barrett Company, 17 Battery Place, New York City.
Arcadian Sulphate of Ammonia

Berkshire Fertilizer Co., Bridgeport, Conn.
Berkshire Ammoniated Bone Phosphate
Berkshire Complete Fertilizer

Berkshire Complete Tobacco
Berkshire Dry Ground Fish
Berkshire Economical Grass Fertilizer
Berkshire Fine Ground Bone
Berkshire Grass Special
Berkshire Long Island Special
Berkshire Market Garden Fertilizer
Berkshire Potato and Vegetable Phosphate
Berkshire Tobacco Grower
Berkshire Tobacco Starter
Acid Phosphate
Castor Pomace
Nitrate of Soda
Sheep Manure

Boardman, F. E., Middletown, Conn.
Boardman's Fertilizer for General Crops

Bowker Fertilizer Company, 60 Trinity Place, New York City.
Bowker's All Round Fertilizer
Bowker's Conn. Valley Tobacco Fertilizer
Bowker's Corn, Grain and Grass Phosphate
Bowker's Fisherman's Brand Fish and Potash
Bowker's Four Ten Hill and Drill
Bowker's Fresh Ground Bone
Bowker's Hill and Drill Phosphate
Bowker's Lawn and Garden Dressing Revised
Bowker's Nitrate of Soda
Bowker's Potato and Vegetable Phosphate
Bowker's 16% Acid Phosphate
Bowker's Soluble Phosphate
Bowker's Square Brand Farm and Garden Phosphate
Bowker's Superphosphate with Ammonia 1%
Bowker's Superphosphate with Ammonia 2%
Bowker's Superphosphate with Ammonia 3%
Bowker's Superphosphate with Ammonia 4%
Bowker's Superphosphate with Ammonia 5%
Bowker's Sure Crop Phosphate Revised
Bowker's Three Ten All Round
Bowker's Tobacco Grower
Bowker's Two Ten Farm and Garden
Stockbridge Complete
Stockbridge Market Garden Manure
Stockbridge Tobacco Manure
Stockbridge Top Dressing and Forcing Manure

Breck, Joseph, & Sons, Corp'n, 51 North Market St., Boston, Mass.
Breck's Rams Head Brand Sheep Manure

Brodé, F. W., & Co., 119 Madison Ave., Memphis, Tenn.
Dove Brand Cotton Seed Meal
Jay Brand Cotton Seed Meal
Owl Brand High Grade Cotton Seed Meal

Buckeye Cotton Oil Company, Cincinnati, Ohio.
Buckeye Good Cotton Seed Meal
"Buco" Cottonseed Feed

Chicago Feed & Fertilizer Company, 809 Exchange Ave., Union Stock Yards, Chicago, Ill.
Magic Brand Pulverized Sheep Manure

Chittenden, E. D., Company, Bridgeport, Conn.
Chittenden's Complete Tobacco and Onion Grower
Chittenden's Complete Tobacco and Onion Grower without Potash
Chittenden's Tobacco Special with 5% Potash
Chittenden's Tobacco Special without Potash
Chittenden's Vegetable and Onion Grower without Potash

Clark, Everett B., Seed Company, Milford, Conn.
Special Mixture for General Use
Special Mixture with Potash

Coe-Mortimer Co., 51 Chambers St., New York City.
E. Frank Coe's Basic Fruit and Legume Phosphate (Basic Lime Phosphate) (Key-Plow Brand)
E. Frank Coe's Celebrated Special Potato Fertilizer Revised
E. Frank Coe's Columbian Corn and Potato Fertilizer
E. Frank Coe's Connecticut Wrapper Grower
E. Frank Coe's Corn King
E. Frank Coe's Dissolved Phosphate and Potash
E. Frank Coe's Gardeners' and Truckers' Special 1916
E. Frank Coe's Gold Brand Excelsior Guano Revised
E. Frank Coe's H. G. Ammoniated Superphosphate 1916
E. Frank Coe's New Englander Special
E. Frank Coe's Nitrate of Soda
E. Frank Coe's Prolific Crop Producer 1916
E. Frank Coe's 16% Superphosphate
E. Frank Coe's Special Grass Top Dressing
E. Frank Coe's Tobacco Leaf Fertilizer
E. Frank Coe's Tobacco Special
Fine Ground Bone

Columbia Guano Co., Munsey Building, Baltimore, Md.
Columbia Freedom Guano
Columbia Soluble Guano

Conn. Fat Rendering & Fertilizing Corp'n., P. O. Box 228, New Haven, Conn.
Tankage

Davis, S. P., Little Rock, Ark.
Good Luck Brand of Cottonseed Meal and Cracked Screened Cake

Dexter Portland Cement Co., Nazareth, Pa.
Dexter Potash Lime Fertilizer

Essex Fertilizer Company, 39 North Market St., Boston, Mass.
Essex Fish Fertilizer 3-8-3
Essex Market Garden 3-8-4
Essex Tobacco 5-5-4
Essex Tobacco 5-6
Essex Tobacco 5-7-2
Essex 1-10-1
Essex 2-8-2
Essex 3½-10
Essex 4-8-4

Fertile Chemical Company, Cleveland, Ohio.
Lime-Fertile
Nitro-Fertile

Frisbie, L. T., Co., New Haven, Conn.
Castor Pomace
Frisbie's Acid Phosphate 16%
Frisbie's Corn and Grain Fertilizer

Frisbie's Fine Bone Meal
Frisbie's 5-8
Frisbie's Special
Frisbie's Special Vegetable and Potato Grower
Frisbie's 3-8
Frisbie's 3-8-3
Frisbie's Tobacco 5-5-5
Frisbie's Tobacco 5-6
Frisbie's Tobacco Grower
Frisbie's Tobacco Special
Frisbie's 2-8
Frisbie's 4-10
Ground Tankage
Nitrate of Soda

Hall, W. D., Company, Atlanta, Ga.
Good Cotton Seed Meal

Hubbard Fertilizer Co., 802 Keyser Bldg., Baltimore, Md.
Hubbard's Excelsior Mixture
Hubbard's Farmers I X L
Hubbard's 5% Royal Seal
Hubbard's 4-10-0
Hubbard's New England Special
Hubbard's Nitrate of Soda
Hubbard's Noxall Guano
Hubbard's 16% Phosphate
Hubbard's Tobacco Fertilizer
Hubbard's Yellow Wrapper

Humphreys-Godwin Co., Memphis, Tenn.
Bull Brand Cottonseed Meal
Danish Brand Cottonseed Meal
Dixie Brand Cottonseed Meal
Forfat Brand Cottonseed Meal
Unit—1
Unit—2

Industrial Cotton Oil Properties, 65 Broadway, New York City.
"High Grade Cotton Seed Meal"

International Agricultural Corporation, Buffalo Fertilizer Works, Buffalo, N. Y.
Bone Meal
Buffalo Ammoniated Phosphate
Buffalo Economy
Buffalo Farmers Choice
Buffalo General Favorite
Buffalo High Grade Manure
Buffalo New England Special
Buffalo Onion, Vegetable and Potato
Buffalo Phosphate and Potash
Buffalo Three Ten
Buffalo Tobacco Grower
Buffalo Tobacco Producer
Buffalo Tobacco Special
Buffalo Top Dresser and Starter
I. A. C. Tobacco Crop

Joynt, John, Lucknow, Ont.
The Joynt Brand Canada Unbleached Hardwood Ashes

Koster, A. L., Suffield, Conn.
Dry Ground Fish
Hale Tobacco Mixture

Listers Agricultural Chemical Works, Newark, N. J.
Listers Ammoniated Dissolved Superphosphate Revised
Listers Bone Meal 1916
Listers Buyer's Choice Acid Phosphate
Listers Celebrated Ground Bone and Tankage Acidulated
Listers Celebrated Tobacco Fertilizer
Listers Complete Tobacco Manure
Listers Corn and Potato Fertilizer
Listers Eastern Pride Fertilizer
Listers H. G. Acid Phosphate
Listers King Bee Fertilizer
Listers Plant Food 1916
Listers Special Crop Producer
Listers Special Tobacco Fertilizer
Listers Standard Pure Superphosphate of Lime
Listers Success Fertilizer
Listers Superior Ammoniated Superphosphate 1916

Lovitt, L. B., & Co., Memphis, Tenn.
"Maloney's Pride No. 1" (7)
"Maloney's Pride No. 2" (6)
"Maloney's Pride No. 3" (8)

Lowell Fertilizer Co., 40 North Market St., Boston, Mass.
Acid Phosphate 16%
Lowell Animal Brand 3-8-4
Lowell Bone Fertilizer 2-8-2
Lowell Dissolved Bone Fertilizer 2-10
Lowell Empress Brand 1-10-1
Lowell 3½-10
Lowell 2-8-3
Lowell 3-8-3
Lowell 4-8-4
Lowell 5-8
Lowell 5-8-4
Lowell Ground Bone 2½-26
Lowell Lawn and Garden Dressing 4-7-2
Lowell Tobacco 5-5-4
Lowell Tobacco 5-6
Lowell Tobacco 5-7-2
Nitrate of Soda

Lyle & Lyle, Huntsville, Ala.
"Economy" C. S. Feed

Mapes Formula & Peruvian Guano Co., 143 Liberty St., New York City.
Mapes Corn Manure
Mapes C. S. Tobacco Manure
Mapes General Crop (1916 Brand)
Mapes General Tobacco Manure
Mapes General Truck Manure
Mapes Grain Brand
Mapes Potato Manure
Mapes Potato Manure (1916 Brand)
Mapes Tobacco Starter, Improved

National Fertilizer Co., 60 Trinity Place, New York City.
National Ammoniated Bone Phosphate
National Complete Grass Fertilizer

National Complete Tobacco Fertilizer
National Eureka Potato Fertilizer
National 5-4 Tobacco Manure
National Market Garden Fertilizer Revised
National Nitrogen Phosphate Mixture No. 1
National Nitrogen Phosphate Mixture No. 2
National Nitrogen Phosphate Mixture No. 3
National Nitrogen Phosphate Mixture No. 4
National Nitrogen Puosphate Mixture No. 6
National Pine Tree State Potato Fertilizer
National Potato Phosphate
National 16% Plain Superphosphate
National Soluble Bone and Potash
National Special Tobacco Revised
National Universal Phosphate
National XXX Fish and Potash

Natural Guano Co., Aurora, Ill.
"Sheep's Head" Pulverized Sheep Manure

New England Fertilizer Co., 40A North Market St., Boston, Mass.
N. E. Superphosphate 3-8-4
N. E. Tobacco 5-4
N. E. Tobacco 5-5-4
N. E. Tobacco 5-6
N. E. 1-10-1
N. E. 2-8-2
N. E. 2-8-3
N. E. 3-8-3
N. E. 3½-10
N. E. 5-8-7

Nitrate Agencies Co., 85 Water St., New York City.
N. A. C. Brand Acid Phosphate
N. A. C. Brand 8-6-5 Truckers Top Dresser
N. A. C. Brand 4-8-4 Potato Formula
N. A. C. Brand Ground Bone
N. A. C. Brand Muriate of Potash
N. A. C. Brand Nitrate of Soda
N. A. C. Brand 2-8-2 All Crop Formula

Nothern, W. C., Box 414, Memphis, Tenn.
Special No. 1 (Cotton Seed Meal)

Olds & Whipple, Hartford, Conn.
Acid Phosphate
Nitrate of Soda
O & W Complete Corn, Potato and Onion Fertilizer
O & W Complete Tobacco Fertilizer
O & W Dry Ground Fish
O & W Grass Fertilizer
O & W H. G. Tobacco Starter
O & W Special Corn, Onion and Potato Fertilizer
O & W Tobacco Special Fertilizer
Precipitated Bone Phosphate

Pacific Manure & Fertilizer Co., 429 Davis St., San Francisco, Calif.
Groz-It-Brand Pulverized Sheep Manure

Park & Pollard Co., Boston, Mass.
P. & P. Offcolored Cottonseed Meal
Upland Cottonseed Meal

Parmenter & Polsey Fertilizer Co., 41 North Market St., Boston, Mass.
P & P, Plymouth Rock 3-8-4
P & P Tobacco 5-4
P & P Tobacco 5-5-4
P & P 1-10-1
P & P 2-8-2
P & P 2-8-3
P & P 2-10
P & P 3½-10
P & P 4-8-4 for Potatoes, Corn and Vegetables

Pawtucket Rendering Co., Pawtucket, R. I.
Ground Bone
2-8-2 Brand
3-8-4 Animal Brand
4-8-4 Brand
5-8-4 Brand

Piedmont-Mt. Airy Guano Co., Baltimore, Md.
Brown's Fertilizer for Corn and Grain
Brown's H. G. P. and General Crop Manure
Brown's Potato Fertilizer
Brown's Special Fertilizer
Brown's Special O & T and Market Garden
Brown's Tobacco Manure
Muriate of Potash
Nitrate of Soda
Piedmont 3-8-4 Fertilizer
Piedmont 4-8-6 Fertilizer
Piedmont 16% Acid Phosphate
Piedmont 3 50 Bone Meal
Piedmont 6 30 Tankage
Shay's Corn Fertilizer
Shay's Potato Fertilizer
Shay's Special Fertilizer

Pulverized Manure Co., 828 Exchange Ave., Union Stock Yards, Chicago, Ill.
Wizard Brand Manure

Quality Fertilizer Works, 52 Canal St., Stamford, Conn.
Bartlett Brand Special Tree Fertilizer

Robinson, George B., Jr., 18 Broadway, New York City.
"Robin" Brand Cotton Seed Meal

Rogers & Hubbard Company, Middletown, Conn.
Hubbard's "Bone Base" Fertilizer for Seeding Down
Hubbard's "Bone Base" Oats and Top Dressing
Hubbard's "Bone Base" Soluble Corn and General Crops Manure
Hubbard's "Bone Base" Soluble Potato Manure
Hubbard's Pure Raw Knuckle Bone Flour
Hubbard's Strictly Pure Fine Bone
R. & H.'s All Soils-All Crops Phosphate
R. & H.'s Climax Tobacco Brand
R. & H.'s Complete Phosphate
R. & H.'s Cottonseed Meal
R. & H.'s Potato Phosphate
R. & H.'s Soluble Tobacco Manure
R. & H.'s Tobacco Grower, Vegetable Formula

Royster, F. S., Guano Company, 1603 Munsey Bldg., Baltimore, Md.
Dry Ground Fish
Kainit

Muriate of Potash
Nitrate of Soda
Royster's Arrow Head Tobacco Formula
Royster's Banner Guano
Royster's Bully Guano
Royster's Dreadnought Guano
Royster's Fish and Potash
Royster's Fish, Flesh and Foul Guano
Royster's Landmark Brand
Royster's Perfecto Tobacco Formula
Royster's Prime Fish Brand
Royster's Purity Brand
Royster's Quality Trucker
Royster's 16% Acid Phosphate
Royster's Truckers' Delight
Royster's Valley Tobacco Formula
Stevens Formula

Sanderson Fertilizer & Chemical Co., New Haven, Conn.
Sanderson's Acid Phosphate
Sanderson's Atlantic Coast Bone, Fish and Potash
Sanderson's Complete Tobacco Grower
Sanderson's Corn Superphosphate
Sanderson's Fine Ground Bone
Sanderson's Formula A
Sanderson's Formula B
Sanderson's H. G. Ammoniated Phosphate
Sanderson's Kelsey's Bone, Fish and Potash
Sanderson's Nitrate of Soda
Sanderson's Phosphate without Potash
Sanderson's Potato Manure
Sanderson's Special without Potash
Sanderson's Tobacco Grower
Sanderson's Top Dressing for Grass and Grain
Sanderson's Top Dressing for Grass and Grain without Potash
South American Sheep and Goat Manure

Shoemaker, M. L., & Co., Inc., Venango St. and Delaware Ave., Philadelphia, Pa.
Swift-Sure Bone Meal
Swift-Sure Superphosphate for General Use
Swift-Sure Superphosphate for Potatoes No. 1
Swift-Sure Superphosphate for Tobacco
Swift-Sure Tankage

Soper, J. E., Co., 206 Chamber of Commerce, Boston, Mass.
Pilgrim Cottonseed Meal
Pioneer Cottonseed Meal
Puritan Cottonseed Meal
Soper's 5% Nitrogen C/S Meal
Soper's 6% Nitrogen C/S Meal
Soper's 7% Nitrogen C/S Meal

Southern Cotton Oil Company, Falls Building, 22 N. Front St., Memphis, Tenn.
Cotton Seed Meal

Springfield Rendering Co., 88 Liberty St., Springfield, Mass.
Springfield Animal Brand
Springfield Fine Ground Bone
Springfield Grain and Grass
Springfield Tobacco Special

Taylor Commission Co., Atlanta, Ga.
(Good Cotton Seed Meal) Taylor Brand

Union Seed & Fertilizer Co., 65 Broadway, New York City.
American Red Tag Cotton Seed Meal
Surety Brand Cotton Seed Meal
Yellow Tag Cotton Seed Meal

Virginia-Carolina Chemical Co., Equitable Building, 120 Broadway, New York City.
V-C Bone Meal
V-C Challenge Brand
V-C Champion Brand
V-C Cherokee Brand
V-C Fish and Potash Brand
V-C Indian Chief Brand
V-C Monarch Brand
V-C Owl Brand
V-C Pawnee Brand
V-C Plant Food for Vegetables, Lawns and Flowers
Virginia-Carolina Plow Brand

Wilcox Fertilizer Company, Mystic, Conn.
Acid Phosphate
Eldredge Fish and Potash
Nitrate of Soda
Wilcox Corn Special
Wilcox Dry Ground Fish
Wilcox Fish and Potash
Wilcox Grain Fertilizer
Wilcox Grass Fertilizer
Wilcox High Grade Fish and Potash
Wilcox Potato and Vegetable Phosphate
Wilcox Potato Fertilizer
Wilcox Tobacco Special

Witherbee, Sherman & Company, 393 Main St., Worcester, Mass.
Barium-Phosphate Grade A
Barium-Phosphate Grade B
Barium-Phosphate Grade C
Ground Phosphate Rock
Nitrate of Soda

Woodruff, S. D., & Sons, Orange, Conn.
Sheep Manure
Woodruff's Home Mixture

Worcester Rendering Co., Auburn, Mass.
Prosperity Brand Royal Worcester Corn and Grain Fertilizer
Prosperity Brand Royal Worcester Ground Steamed Bone
Prosperity Brand Royal Worcester Potato and Vegetable Fertilizer
Prosperity Brand Royal Worcester Special Grain Fertilizer

World's Fertilizer Process Co., Sharpsburg, Pa.
Shur-Gro

During the year Mr. Churchill, the Station's Agent, has visited 105 towns and villages in the State and gathered 547 samples, in the manner provided by law. Twenty of these registered brands have not been sold in the State, and seventy-eight, although reported to have been sold in Connecticut, could not be found by the sampling agent and therefore have not been examined.

In the following pages are given the analyses of all the brands which were sampled, as well as those sent for analysis by individuals. Of the latter the Station is not responsible for the accuracy of the sampling, although pains have been taken to secure from the senders certification that the Station's method of sampling was followed.

CLASSIFICATION OF FERTILIZERS ANALYZED.

	Number of samples.
1. *Containing nitrogen as the chief active ingredient:*	
Nitrate of soda	14
Sulphate of ammonia	1
Cotton seed meal	115
Castor pomace	3
2. *Containing phosphoric acid as the chief active ingredient:*	
Barium-phosphate	3
Raw rock phosphate	2
Precipitated bone phosphate	1
Basic lime phosphate	2
Dissolved rock phosphate or acid phosphate	20
3. *Containing potash as the chief active ingredient:*	
Cotton hull ashes	1
Potash salts and potash-lime	4
4. *Raw materials containing nitrogen and phosphoric acid:*	
Fish manures	16
Slaughter house tankage	15
Bone manures	19
Mixed bone and tankage	1
Garbage tankage	1
5. *Mixed fertilizers:*	
Nitrogenous superphosphates without potash	92
Nitrogenous superphosphates with potash	246
Home mixtures	16
6. *Miscellaneous fertilizers and waste products:*	
Tobacco stems, stalks and dust	4
Nitro-Fertile and Lime-Fertile	2
Sheep manure	9
Wood ashes	19
Lime and lime-kiln ashes	4
Other miscellaneous materials	15
Total	625

I. RAW MATERIALS CHIEFLY VALUABLE FOR NITROGEN.

NITRATE OF SODA.

Fourteen samples were analyzed as follows:

14484. Sold by the Berkshire Fertilizer Co., Bridgeport. Sampled at the factory.

14487. Sold by Apothecaries Hall Co., Waterbury. Stock of R. H. Morgan, West Cheshire.

14488. Sold by F. S. Royster Guano Co., Baltimore, Md. Stock of J. R. Reinhard & Sons, West Cheshire.

15149. Sold by Coe-Mortimer Co., New York. Stock of Conyer's Farm, Greenwich.

14479. Sold by Olds & Whipple, Hartford. Sampled at the factory.

14935. Sold by Piedmont-Mt. Airy Guano Co, Baltimore, Md. Stock of Farmers' Exchange, Woodstock.

15045. Sold by the Hubbard Fertilizer Co., Baltimore, Md. Stock of H. H. McKnight, Ellington.

14419. Sold by American Agricultural Chemical Co., New York. Stock of E. N. Austin, Suffield.

15205. Sold by the Atlantic Packing Co., New Haven. Sampled at the factory.

15206. Sold by L. T. Frisbie Co., New Haven. Stock of P. Schwartz Co., New London.

14477. Sold by Sanderson Fertilizer & Chemical Co., New Haven. Sampled at the factory.

14572. Sold by Wilcox Fertilizer Co., Mystic. Stock of G. R. Stannard, Branford.

15075. Sold by the Lowell Fertilizer Co., Boston. Stock of Litchfield County Coop. Association, Torrington.

14828. Sold by the Bowker Fertilizer Co., New York. Stock of F. B. Newton Est., Plainville.

TABLE I. ANALYSES OF NITRATE OF SODA.

Station No.	Per cent. of Nitrogen Guaranteed.	Per cent. of Nitrogen Found.	Cost per ton.	Nitrogen costs cents per pound.
14484	14.80	15.44	$70.00	22.6
14487	15.00	15.50	70.00	22.6
14488	15.00	15.54	74.75	24.0
15149	15.00	15.40	75.00	24.3
14479	15.00	15.34	75.00	24.4
14935	15.22	15.30	75.76	24.7
15045	15.22	15.24	76.15	24.9
14419	15.00	15.68	80.00	25.5
15205	15.00	15.16	80.00	26.4
15206	15.00	15.32	85.00	27.7
14477	15.00	15.42	86.75	28.1
14572	15.00	14.94	86.00	28.8
15075	15.00	15.28	90.00	29.4
14828	15.00	15.76	.....	....

The retail cash cost of nitrogen in nitrate of soda has ranged from 22.6 to 29.4 cents per pound, and has averaged 25.6 cents per pound.

SULPHATE OF AMMONIA.

One sample was examined.

14483. Sold by the Barrett Co., of New York City. Stock of Berkshire Fertilizer Co. Cost $100 per ton. It contained 20.92 per cent. nitrogen.

Nitrogen in this sample costs 23.9 cents per pound. Sulphate of ammonia and nitrate of soda have been altogether the cheapest forms of available nitrogen in our market.

COTTON SEED MEAL.

One hundred and fifteen samples have been examined, and their analyses appear in the following table.

The per cent of nitrogen has ranged from 5.10 to 8.11 per cent, the average being 6.50—very decidedly higher than in any season since 1916.

There has been considerable fluctuation in price during the winter and spring, the average being $79.55 per ton. Making no valuation of the phosphoric acid and potash in the meal, the average cost of nitrogen in meal has been 61.2 cents per pound.

If the phosphoric acid contained in the meal were credited at 7 cents per pound and potash at 12 cents per pound, the cost of nitrogen would be about 54½ cents per pound. Twenty-eight of the samples did not meet their guaranties, but eight of these were sold on a unit basis so that the buyer only paid for the actual amount of nitrogen received, which is altogether the most satisfactory basis of payment. The prices ranged from $70 to $90 per ton, following in some measure the fluctuations in the wholesale market.

TABLE II. ANALYSES OF COTTON SEED MEAL.

Manufacturer or Jobber, Car No. or Marks.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.	Cost per ton.
American Cotton Oil Co., New York City.				
American Red Tag, C. S. Meal	J. E. Phelps, Suffield	6.31	6.18	$68.12
Ashcraft-Wilkinson Co., Atlanta, Ga.				
Paramount Brand C. S. Meal	Station Agent from Rockville Milling Co	6.14	5.76	83.00
F. W. Brodé & Co., Memphis, Tenn.				
Owl Brand	A. D. Bridge's Sons, Inc., Hazardville	6.32	6.50	....
Owl Brand, E. 74666	W. J. Reeves, Windsorville	6.18	6.50	75.10
Owl Brand, C. & N. W., 180500	Spencer Bros., Suffield	6.90	6.85	79.19
Owl Brand	E. H. Rollins, Granby	6.56	6.50	74.50
Owl Brand	Station Agent from A. D. Bridge's Sons	6.27	6.50	87.00
Owl Brand, N. Y. C., 230350	G. T. Soule, New Milford	6.64	6.50	80.00
Owl Brand	Station Agent from G. E. Ackley Co., New Milford	6.63	6.50	80.00
Owl Brand	S. F. Holcomb & Son, West Granby	6.89	6.50	77.00
Jay Brand, S. P., 84389	Station Agent from A. D. Bridge's Sons, Hazardville	5.84	5.76	79.00
....	E. H. Rollins, Granby	6.58	6.50	75.00
....	E. H. Rollins, Granby	6.60	6.50	74.00
?. E. T., 18543	William J. Reeves, Windsorville	6.68	6.50	81.20
Soo L., 31488	G. T. Soule, New Milford	6.29	6.50	75.00
Off Color, C. S. M., S. L. 104426	Ahern Bros., East Windsor Hill	6.65	6.50	......
Off Grade, C. S. M., N. Y. C. 230350	A. W. Camp, Danbury	6.60	6.50	80.00
Cotton Seed Products Co., Louisville, Ky.				
Prime C. S. Meal	Station Agent from Wybern Farms, Melrose	6.21	6.50	76.00
S. P. Davis, Little Rock, Ark.				
Good Luck Brand	L. P. Abbe, Hazardville	6.78	6.50	87.00
Good Luck Brand	Station Agent from E. M. Waller, Gaylordsville	6.49	6.50	82.00

TABLE II. ANALYSES OF COTTON SEED MEAL—(*Continued*).

Station No.	Manufacturer or Jobber, Car No. or Marks.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
	DeSoto Oil Co., Memphis.			
14529	104426	R. H. Osborne, Warehouse Point	6.66	6.58
	E. St. Louis Cotton Oil Co., National Stock Yards, Ill.			
15021	R. I. 56053	C. D. Cannon, Windsor Locks	6.73	6.64
	W. D. Hall Co., Atlanta, Ga.			
14434	Good C. S. Meal	A. D. Ellsworth, Broad Brook	5.32	5.76
14618	Good C. S. Meal	Station Agent from A. E. Hall, Wallingford	5.89	5.76
	Oscar Holway, Auburn, Me.			
14887	N. Y. C. 214957	William Gilligan, Windsor	6.80	6.70
	Humphreys-Godwin Co., Memphis, Tenn.			
14941	Bull Brand,	P. T. McCue, Windsor Locks	6.98	6.87
15076	Bull Brand	Station Agent from E. Manchester & Sons, Winsted	7.16	6.87
15192	Bull Brand	J. A. Sherwood, Long Hill	7.09	6.87
15222	Bull Brand	C. L. Luce, New Britain	6.92	6.87
14659	Danish Brand	Station Agent from G. S. Phelps, Thompsonville	5.45	5.75
15133	Danish Brand	The Coles Co., Middletown	5.84	5.75
15187	Danish Brand	W. E. Wheelock, Quinebaug	5.81	5.75
14507	Dixie Brand, 89546	Hartford Tobacco Corporation, Hartford	7.49	7.50
15134	Bright C. S. Meal, Penn. 32253	Jno. Sullivan & Son, Thompsonville	5.49	5.76
15135	Bright C. S. Meal, L. V. 82216	Jno. Sullivan & Son, Thompsonville	5.67	5.76
15164	Bright C. S. Meal, C. & N. W. 101624	Spencer Bros., Suffield	5.54	5.76
15341	26206	Coles Co., Middletown	6.16	5.76
14784	Off-Color C. S. Meal, W. B. 45334	G. S. Phelps & Co., Thompsonville	5.67	5.75
14872	Off-Color C. S. Meal, Pa. 63451	Spencer Bros., Suffield	6.31	6.58
14901	Off-Color C. S. Meal, C. M. & St. P. 75860	Spencer Bros., Suffield	5.53	5.58
15145	Off-Color C. S. Meal, 246729	The Coles Co., Middletown	6.83	6.88
14386	Off-Grade C. S. Meal, A. T. & S. F. 31182	G. T. Soule, New Milford	6.26	6.27
14403	C. S. Meal, C. & O. 8803	The Coles Co., Middletown	6.00	5.75
14473	C. S. Meal, 111209	G. S. Phelps & Co., Thompsonville	5.92	5.75
14508	C. S. Meal, B. & M. 62922	L. B. Haas & Co., Hartford	7.34	7.50

TABLE II. ANALYSES OF COTTON SEED MEAL—(*Continued*).

	Manufacturer or Jobber, Car No. or Marks.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.	Cost per ton.
	Humphreys-Godwin Co., Memphis, Tenn. (*Continued*).				
10	Off-Grade C. S. Meal, P. M. 70929	S. J. Orr, West Suffield	6.44	..	$72.
11	Off-Grade C. S. Meal, M. O. P. 34509	S. J. Orr, West Suffield	6.59	..	74.
12	Off-Grade C. S. Meal, G. T. 25226	S. J. Orr, West Suffield	6.17	..	69.
13	Off-Grade C. S. Meal, G. E. T. 2125	S. J. Orr, West Suffield	6.19	..	69.
14	Off Grade C. S. Meal, C. C. C. & S. T. L. 53951	S. J. Orr, West Suffield	6.06	..	68.
15	Off-Grade C. S. Meal, N. Y. C. 255143	S. J. Orr, West Suffield	6.12	..	69.
16	Dark C. S. Meal, Chi., St. P. 28404	H. C. Nelson, West Suffield	5.77	5.75	66.
15	C. S. Meal, 101182	Coles Co., Middletown	5.76	5.76	78.
	L. B. Lovitt & Co., Memphis, Tenn.				
14	Off Color C. S. Meal, M. C. 60060	Spencer Bros., Suffield	6.99	7.13	80.
12	Off -Color C. S. Meal	O. T. Cone, Warehouse Point	7.56	7.20	88.
14	Off-Color C. S. Meal	J. B. Parker, Poquonock	7.63	..	79.
10	Off-Color C. S. Meal, N. P. 19112	Spencer Bros., Suffield	7.64	7.57	92.
0	Off-Color C. S. Meal, K. C. S. 12532	Spencer Bros., Suffield	7.66	7.92	90.
11	Off-Color C. S. Meal, P. R. R. 48725	Spencer Bros., Suffield	7.02	6.87	80.
11	Off-Color C. S. Meal, C. B. Q. 105732	Spencer Bros., Suffield	7.23	7.25	82.
12	Off-Color C. S. Meal, St. Fe 30995	Spencer Bros., Suffield	6.30	6.29	72.
13	Off-Color C. S. Meal, M. C. 46667	Spencer Bros., Suffield	6.92	6.99	79.
18	Off-Color C. S. Meal, I. C. 24343	Spencer Bros., Suffield	6.89	6.89	78.
19	Off-Color C. S. Meal, Penn. 35562	Spencer Bros., Suffield	6.89	6.68	78.
9	Off-Color C. S. Meal, F. W. D 4635	Spencer Bros., Suffield	6.19	6.39	71.
12	Off-Color C. S. Meal, I. & G. N. 5507	Spencer Bros., Suffield	6.69	6.58	76.
13	Off-Color C. S. Meal, S. L. & S. F. 40673	Spencer Bros., Suffield	6.36	6.35	72.

TABLE II. ANALYSES OF COTTON SEED MEAL—(*Continued*).

Station No.	Manufacturer or Jobber, Car No. or Marks.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
	L. B. Lovitt & Co., Memphis, Tenn. (*Continued*).			
14469	Off-Color C. S. Meal, P. L. 535715	John Edgar, Enfield	6.85	6.85
14470	Off-Color C. S. Meal, N. Y. C. 229466	Spencer Bros., Suffield	6.78	6.87
14528	Off-Color C. S. Meal, L. E. & W. 12215	Spencer Bros., Suffield	6.80	6.82
14550	Off-Color C. S. Meal, L. V. 85869	Spencer Bros., Suffield	6.74	6.82
14801	Off-Color C. S. Meal, B. & M. 47599	Spencer Bros., Suffield	6.87	6.81
14829	Off-Color C. S. Meal, L. & N 7607	Spencer Bros., Suffield	6.60	6.50
14494	Off-Color C. S. Meal, B. & O. 89651	Spencer Bros., Suffield	8.11	8.00
14586	Off-Color C. S. Meal, A. T. & S. Fe 7460	Spencer Bros., Suffield	8.07	8.27
	Lyle & Lyle, Huntsville, Ala.			
14384	Economy Brand Sou 120566	G. T. Soule, New Milford	5.92	5.75
	W. C. Nothern, Memphis.			
14377	Special No. 1, T. P. 8055	G. S. Phelps, Warehouse Point	6.75	6.50
14415	Off-Color, 120719	J. W. Crowell, Burnside	6.39	5.75
	Park & Pollard Co., Boston.			
14571	Upland C. S. Meal	Station Agent from F. B. Newton Est., Plainville	5.67	5.75
14297	Off-Color C. S. Meal	Rockville Milling Co.	6.67	6.50
14335	B. & L. E. 81002	Ahern Bros., E. Windsor Hill	7.12	6.50
14337		L. C. Daly, Warehouse Point	7.16	6.50
14460	B. & O. 85534	Broad Brook Lumber & Coal Co.	7.26	7.43
14461	B-4 45144	Broad Brook Lumber & Coal Co.	7.03	7.28
14465	Off-Qual., C. C. C. & St. L. 9266	Station Agent from Broad Brook L. & C. Co	7.15	5.76
14500	G. T. 10102	E. H. Rollins, Granby	6.44	6.58
14504	L. & N. 3460	Broad Brook Lumber & Coal Co.	7.58	7.36
14505	C. of G. 60017	Broad Brook Lumber & Coal Co.	7.37	7.13
14630	S. S. W. 7320	E. H. Rollins, Granby	6.42	6.58
14826	Off-Grade	Station Agent from G. E. Ackley Co., New Milford	6.81	7.00
	The Roger & Hubbard Co., Middletown.			
14466	C. & O. 3223	Station Agent from P. F. Chamberlain, Broad Brook	6.75	6.50

TABLE II. ANALYSES OF COTTON SEED MEAL—(*Concluded*).

	Manufacturer or Jobber, Car No. or Marks.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.	Cost per ton.
	Sanderson Fertz. & Chem. Co., New Haven.				
09	....	Benjamin Fenn, Milford.........	6.71	..	...
	J. E. Soper & Co., Boston.				
51	Puritan C. S. Meal.......	J. B. Cannon, Granby..........	6.09	5.75	$78.
.89	Puritan C. S. Meal.......	The Coles Co., Middletown......	5.20	5.75	80.
61	Puritan C. S. Meal.......	Station Agent from P. Schwartz Co., New London.............	5.26	5.75	80.
93	Off-Color C. S. Meal......	Spencer Bros., Suffield..........	7.36	7.38	86.
97	Off-Color C. S. Meal, C. P. 205692...............	Spencer Bros., Suffield..........	7.40	7.22	84.
93	Off-Color C. S. Meal, 138752...............	L. C. Seymour, Windsor Locks...	5.10	5.76	74.
22	Off-Color C. S. Meal, 138752...............	Station Agent from L. C. Seymour	5.27	5.76	74.
31	....	H. F. Farnham, E. Windsor Hill.	6.25	5.76	75.
11	Off-Color C. S. Meal, N. P. 38946................	W. E. Bates, East Granby.......	5.84	5.76	74.
99	....	C. H. Northam, Hartford......	5.49	5.76	77.
86	Off-Color C. S. Meal, Penn. 608298...............	J. T. O'Neill, Burnside..........	5.95	5.76	77.
70	Off-Color C. S. Meal......	Station Agent from A. Manning, So. Manchester.............	5.24	5.76	69.
91	Off-Color C. S. Meal......	Arthur Manning, Manchester....	5.42	5.76	69.
	Taylor Commission Co., Atlanta, Ga.				
28	....	Station Agent from Meech & Stoddard, Middletown...........	5.99	5.76	78.
	Terrell Cotton Oil Co.				
95	....	E. T. Hurlburt & Son, Somers...	7.16	6.75	87.
	Texarkana Cotton Oil and Fertilizer Co., Texarkana, Ark.				
16	....	Station Agent from E. N. Austin, Suffield.....................	6.56	6.58	75.
11	....	Station Agent from Rockville Milling Co..................	6.50	..	81.
	Union Seed & Fert'z'r Co., New York.				
09	Surety Brand C. S. Meal..	Station Agent from F. H. Rolf, Guilford....................	6.19	5.76	88.
38	Surety Brand, Erie 110567.	Coles Co., Middletown..........	5.84	5.76	84.
60	Amer. Red Tag C. S. Meal	Station Agent from M. E. Thompson, Ellington...............	6.31	6.18	80.
88	Amer. Red Tag C. S. Meal	J. B. Phelps, Suffield...........	6.35	6.18	70.
	Jobber Unknown.				
30	....	L. J. Prior, East Hartford........	6.59	..	..
:86	....	Arthur Manning, Manchester...	6.65	6.88	90

CASTOR POMACE.

Three samples were analyzed as follows:

14421. Sold by American Agricultural Chemical Co., New York City. Stock of E. N. Austin, Suffield.

14515. Sold by the Apothecaries Hall Co., Waterbury. Sampled at the factory.

14481. Sold by Baker Castor Oil Co., New York City. Stock of Olds & Whipple, Hartford.

ANALYSES OF CASTOR POMACE.

Station No.	14421	14515	14481
Per cent. of			
Nitrogen guaranteed	4.50	4.52	4.50
Nitrogen found	5.29	5.73	5.72
Cost per ton	$60.00	$60.00	$57.00
Nitrogen costs per pound	**56.7**	**52.3**	**49.9**

II. RAW MATERIALS CHIEFLY VALUABLE FOR PHOSPHORIC ACID.

BARIUM-PHOSPHATE.

14977. Grade A. Sold by Witherbee, Sherman & Co., Port Henry, N. Y. Stock of J. H. Miller, Stamford. Guaranteed 28 per cent. phosphoric acid.

14932. Grade B. Sold by Witherbee, Sherman & Co., Port Henry, N. Y. Stock of Geo. S. Carter, Clinton. Guaranteed 16 per cent. phosphoric acid. Cost $25.00 per ton.

14933. Grade C. Sold by Witherbee, Sherman & Co., Port Henry, N. Y. Stock of C. E. Lyman, Middlefield. Guaranteed 14 per cent phosphoric acid. Cost $22.00 per ton.

ANALYSES OF BARIUM-PHOSPHATE.

Station No.	14977	14932	14933
Water-soluble phosphoric acid	**None**	**0.03**	**None**
Citrate-soluble phosphoric acid	3.18	0.59	0.24
Insoluble phosphoric acid	25.16	16.68	16.21
Total phosphoric acid	28.34	17.30	16.45
Phosphoric acid cost cents per pound		**7.2**	**6.7**

RAW ROCK PHOSPHATE.

Two samples were analyzed as follows:

15181. Tacco Ground Phosphate. Sold by Tennessee Agricultural Corporation, Centerville, Tenn. Sent by E. E. Burwell, New Haven.

15150. Raw Ground Phosphate. Sold by Apothecaries Hall Co., Waterbury. Stock of H. A. Edwards, Naugatuck.

Analyses of Raw Rock Phosphate.

Station No.	15181	15150
Water-soluble phosphoric acid	0.16	0.04
Citrate-soluble phosphoric acid	2.31	3.12
Citrate-insoluble phosphoric acid	21.25	28.06
Total phosphoric acid	23.72	31.22
"Available" phosphoric acid found	2.47	3.16
Cost per ton	....	$17.00

15181 was ground phosphate which had been saturated with strong liquid manure, worked over and exposed to the action of air and frost for a year.

PRECIPITATED BONE PHOSPHATE.

One sample was analyzed as follows:

14480. Sold by Olds & Whipple, Hartford. Sampled at factory. Cost $1.50 per unit available phosphoric acid.

Analysis of Precipitated Bone Phosphate.

Station No.	14480
Water-soluble phosphoric acid	0.37
Citrate-soluble phosphoric acid	18.67
Citrate-insoluble phosphoric acid	8.26
Total phosphoric acid	27.30
"Available" phosphoric acid found	19.04
Cost of "available" phosphoric acid per pound	**7.5¢**

BASIC LIME PHOSPHATE.

Two samples were analysed as follows:

15117. Sold by American Agricultural Chemical Co., New York City. Stock of R. E. Morgan, Windsor. Guaranteed 13 per cent. "available" phosphoric acid, 14 per cent. total phosphoric acid. Cost $24.25 f.o.b. factory.

14978. Basic Fruit and Legume Phosphate. Sold by Coe-Mortimer Co., New York City. Stock of J. C. Jackson, Wilton. Cost $22.75 per ton. Guaranteed 13 per cent. "available" phosphoric acid, 14 per cent. total phosphoric acid.

Analyses of Basic Lime Phosphate.

Station No.	15117	14978
Water-soluble phosphoric acid	2.67	3.10
Citrate-soluble phosphoric acid	11.27	10.38
Citrate-insoluble phosphoric acid	1.50	1.46
Total phosphoric acid	15.44	14.94
"Available" phosphoric acid	13.94	13.48
Cost of "available" phosphoric acid per pound		**8.4¢**

DISSOLVED ROCK PHOSPHATE OR ACID PHOSPHATE.

The analyses of twenty samples of this material are given in the table.

The prices charged have ranged from $27 to $40 per ton. The average cost of available phosphoric acid has been about 10.1 cents per pound.

Twenty samples were analyzed as follows:

14476. Sold by Sanderson Fertilizer & Chemical Co., New Haven. Sampled at factory.

14854. Sold by Piedmont-Mt. Airy Guano Co., Baltimore, Md. Stock of Farmers' Exchange, South Meriden.

15042. Sold by the Hubbard Fertilizer Co., Baltimore, Md. Stock of H. H. McKnight, Ellington.

15157. Sold by Olds & Whipple, Hartford. Stock of Haviland Tobacco Co., East Windsor Hill.

14707. Sold by National Fertilizer Co., New York City. Stock of R. Delaney, Somersville.

15207. Sold by Berkshire Fertilizer Co., Bridgeport. Stock of D. L. Clarke & Sons, Milford.

14482. Sold by Olds & Whipple, Hartford. Sampled at factory.

14417. Sold by American Agricultural Chemical Co., New York City. Stock of E. N. Austin, Suffield.

TABLE III. ANALYSES OF ACID PHOSPHATE.

Station No.	Water-soluble phosphoric acid.	Citrate-soluble phosphoric acid.	Citrate-insoluble phosphoric acid.	Total phosphoric acid.	"Available" phosphoric acid found.	"Available" phosphoric acid guaranteed.	Cost per ton.	"Available" phosphoric acid costs cents per pound.
14476	15.39	1.79	0.15	17.33	17.18	16.00	$30.00	8.7
14854	12.17	3.13	1.01	16.31	15.30	16.00	27.00	8.8
15042	14.20	1.87	0.27	16.34	16.07	16.00	29.00	9.0
15157	13.71	3.22	0.93	17.86	16.93	16.00	30.87	9.1
14707	11.16	5.25	0.55	16.96	16.41	16.00	30.90	9.4
15207	14.34	3.27	0.33	17.94	17.61	16.00	33.50	9.5
14482	12.29	3.47	0.15	15.91	15.76	16.00	30.64	9.7
14417	14.64	2.20	0.19	17.03	16.84	16.00	33.00	9.8
14934	11.36	4.64	2.01	18.01	16.00	16.00	32.00	10.0
14542	12.67	2.62	1.64	16.93	15.29	16.00	32.00	10.4
14971	13.26	2.92	0.36	16.54	16.18	14.00	35.00	10.8
15074	12.01	3.70	1.52	17.23	15.71	16.00	34.00	10.8
14499	13.33	1.89	0.90	16.12	15.22	16.00	33.00	10.8
14514	14.02	1.94	0.20	16.16	15.96	14.00	35.00	11.0
14795	13.50	3.32	0.22	17.04	16.82	16.00	38.00	11.3
15113	13.58	2.90	0.32	16.80	16.48	16.00	40.00	12.1
14478	13.55	3.37	0.26	17.18	16.92	16.00	.....	....
14813	14.41	3.19	0.14	17.74	17.60	16.00	.....	....
14879	12.61	2.96	1.39	16.96	15.57	16.00	.....	..
14986	9.52	5.55	1.14	16.21	15.07	16.00	.....	....

The percentage of available phosphoric acid in Sample 14542, Royster's Acid Phosphate, was not so high as guaranteed. A second sample 14879 of the same brand contained a higher percentage of available acid than the first, but still did not fully meet its guaranty.

14934. Sold by Coe-Mortimer Co., New York City. Stock of J. E. Stoddard, Abington.
14542. Sold by F. S. Royster Guano Co., Baltimore, Md. Stock of J. R. Reinhard & Sons, West Cheshire.
14971. Sold by Listers Agricultural Chemical Works, Newark, N. J. Stock of W. H. Carrier, Glastonbury.
15074. Sold by Lowell Fertilizer Co., Boston, Mass. Stock of H. B. Brownson, Shelton.
14499. Sold by Apothecaries Hall Co., Waterbury. Sampled at factory.
14514. Sold by American Agricultural Chemical Co., New York City. Stock of Spencer Bros., Suffield.
14795. Sold by Bowker Fertilzer Co., New York City. Stock of Geo. E. Ackley Co., New Milford.
15113. Sold by Listers Agricultural Chemical Works, Newark, N. J. Stock of B. C. Wooding, Yalesville.
14478. Sold by L. T. Frisbie Co., New Haven. Sampled at factory.
14813. Sold by Wilcox Fertilizer Co., Mystic. Sampled at factory.
14879. Sold by F. S. Royster Guano Co., Baltimore, Md. Stock of W. S. Brown, Trumbull.
14986. Sold by American Agricultural Chemical Co., New York City. Stock of W. H. Latimer & Son, Southington.

III. RAW MATERIALS OF HIGH GRADE CONTAINING POTASH.

COTTON HULL ASHES.

15171. Sent by Olds & Whipple, Hartford. Stock of Windsor Tobacco Growers' Corp., Windsor. It contained 19.42 per cent. of potash.

POTASH SALTS AND OTHER MATERIALS CONTAINING WATER-SOLUBLE POTASH.

14931. Kainit. Sold by F. S. Royster Guano Co., Baltimore, Md. Stock of Knowles, Lombard Co., Guilford. It contained 14.21 per cent. potash and cost $45.00 per ton, making the cost of actual potash 15.8 cents per pound.
14929. Muriate of potash. Sold by F. S. Royster Guano Co., Baltimore, Md. Stock of Knowles, Lombard Co., Guilford. It contained 56.68 per cent. potash and sold for $165 per ton, making the cost of actual potash 14.5 cents per pound.
14284. Nebraska Potash. Sold by Standard Potash Co., Lakeside, Neb. It contained 27.30 per cent. potash.
15023. Potash-Lime. Sent by Dexter Portland Cement Co., Nazareth, Pa. It contained 3.13 per cent. potash and 33.28 per cent. of lime.

IV. MATERIALS CONTAINING NITROGEN AND PHOSPHORIC ACID.

FISH MANURES.

Sixteen samples were examined, eleven of which were sampled by the Station Agent and five by purchasers. Analyses appear in Table IV.

Sample **14585** was stated to be bought by Mr. Fiske for his own use from the New England Fertlizer Co. It is not a brand registered by them.

Three of the samples, **15125**, Lowell Fertilizer Co.; **15114**, Atlantic Packing Co.; and **15136**, A. L. Koster, contained much less nitrogen than was guaranteed.

The average percentage of nitrogen, though with a wide range, is about 8.33; of available phosphoric acid, 6.01; and the cost per ton, ranging from $80 to $115, has averaged about $99.64.

Allowing 10 cents per pound for available phosphoric acid, the nitrogen in fish manures has had an average cost of 52.6 cents per pound.

TABLE IV. ANALYSES OF

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.
	Sampled by Station:	
14418	American Agr. Chem. Co.	E. N. Austin, Suffield
14645	Apothecaries' Hall Co.	Wm. Reeves, Windsorville
15114	Atlantic Packing Co.	John Helm, So. Windsor
14574	Berkshire Fertz. Co.	Manufacturer
14989	East Harbor Fertz. Co.	Wybern Farms, Melrose
15130	A. L. Koster	Michael Cannon, Rockville
15125	Lowell Fertz. Co.	T. J. Coleman, Warehouse Pt.
14585		W. E. Fiske, Warehouse Pt.
14537	Olds & Whipple	Manufacturer
14930	F. S. Royster Guano Co.	C. R. Woodford & Sons, Avon
14644	Wilcox Fertz. Co.	Bloomstein & Adler, Burnside
	Sampled by Purchaser:	
15183[3]	"Fish Meal," East Coast Fisheries Products Co.	American Sumatra Tobacco Co., East Hartford
15136	A. L. Koster	Fassler & Silberman, Hartford
14238	Wilcox Fertz. Co.	American Sumatra Tobacco Co., East Hartford
14346	No. 2	Silverherz Tobacco Co., Rockvill
14345	No. 1	Silverherz Tobacco Co., Rockvill

[1] 0.39 per cent. nitrogen in nitrates. [2] 0.16 per cent. nitrogen in nitrates.

SLAUGHTER HOUSE TANKAGE.

Table V, page 28.

Fifteen samples were examined. Six of these were sampled by the Station Agent, seven were submitted by purchasers, and two by a manufacturer for determinations of nitrogen availability. **14062,** Tankage base, prepared from slaughter-house tankage, contained 1.64 per cent. of water-insoluble organic nitrogen, 78.2 per cent. of which was in active form. **14063,** Bone Tankage, contained 2.79 per cent. of water-insoluble organic nitrogen, 87.0 per cent. of which was in active form. The neutral permanganate method was employed in both cases.

Analyses of the remaining samples appear in Table V.

One of the samples taken by the Station Agent, **15204,** Atlantic Packing Co., was far below its guaranty in nitrogen and phosphoric acid, and four others, **14475** and **14881,** Conn. Fat Rendering and Fertilizing Corp., **14855,** Piedmont-Mt. Airy Guano Co., and **14918,** M. L. Shoemaker & Co., were deficient in phosphoric acid.

Fish Manures.

Nitrogen.				Phosphoric acid.			Total phosphoric acid.		
As ammonia.	As organic.	Total found.	Total guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Cost per ton.
0.23	8.92	9.15	8.23	....	....	....	8.66	6.00	$100.00
0.17	8.81	9.37[1]	8.20	0.50	5.92	1.52	7.94	5.50	115.00
0.18	7.28	7.46	7.81	0.50	5.31	0.43	6.24	5.50	80.00
0.60	7.69	8.29	8.23	0.75	4.52	0.95	6.22	6.00	100.00
0.52	8.48	9.00	8.23	0.70	3.78	0.91	5.39	6.00	95.00
3.90	5.13	9.03	8.23	0.33	5.85	1.60	7.78	3.00	.....
0.21	7.08	7.29	7.81	0.51	4.86	0.23	5.60	5.50	100.00
0.26	7.67	7.93	7.41	0.43	4.93	0.38	5.74	14.00	105.00
0.20	7.85	8.05	8.23	0.57	8.99	4.45	14.01	5.50	99.75
0.23	8.28	8.51	8.22	0.35	7.77	4.03	12.15	5.00	103.00
0.66	7.96	8.78[2]	8.24	1.56	4.49	0.77	6.82	5.00	.....
0.15	9.09	9.24	....	0.58	8.92	3.08	12.58	....	.....
1.16	5.13	6.29	8.23	0.50	6.40	0.58	7.48	3.00	96.00
0.46	8.10	8.56	....	2.38	2.35	0.83	5.56	....	.....
0.20	7.74	7.94	....	0.50	5.82	5.32	11.64	....	.....
0.92	7.78	8.70	....	1.23	4.51	1.33	7.07	....	.....

TABLE V. ANALYSES OF

Station No.	Manufacturer.	Dealer or Purchaser.
	Sampled by Station:	
14486	Apothecaries Hall Co.	R. H. Morgan, West Cheshire
15204	Atlantic Packing Co.	Manufacturer
14475	Conn. Fat Rend. & Fertz. Corp.	Manufacturer
14881	Conn. Fat Rend. & Fertz. Corp.	F. A. Forbes, East Haven
14855	Piedmont—Mt. Airy Guano Co.	Minor Ives, South Meriden
14918	M. L. Shoemaker & Co.	H. B. Cornwall, Meriden
	Sampled by Purchaser:	
15188	Apothecaries Hall Co.	Barnes Bros. Nursery Co.
14344	....	Chas. Johnson, Gaylordsville
15389	Apothecaries Hall Co.	A. N. Pierson, Inc., Cromwell
15382	Godfrey Fertilizer & Chem'l Co., Newark, N.J.	A. N. Pierson, Inc., Cromwell
15383	Godfrey Fertilizer & Chemical Co., Newark, N. J.	A. N. Pierson, Inc., Cromwell
15384	Godfrey Fertilizer & Chemical Co., Newark, N. J.	A. N. Pierson, Inc., Cromwell
15774	Godfrey Fertilizer & Chemical Co., Newark, N. J.	A. N. Pierson, Inc., Cromwell

[1] 0.16 per cent. nitrogen in nitrates.

BONE MANURES.

Table VI, page 30.

The analyses of 19 samples, of which 15 were drawn by the Station Agent, are given in table VI.

14420 is not a brand registered in this State, but is stated to have been shipped by mistake to E. N. Austin by the Springfield Rendering Co., Springfield, Mass.

One sample, **15065,** from the Piedmont-Mt. Airy Guano Co., failed to meet its guaranty of nitrogen.

The average amounts of nitrogen and phosphoric acid found in these samples have been 3.43 and 23.45 per cent. respectively, and the average cost, ranging from $51.50 to $76, has been $63.15. Allowing 50 cents per pound for nitrogen, phosphoric acid has cost 6.1 cents.

GARBAGE TANKAGE.

14696 is tankage prepared from city garbage. Sent by the Health Dept., Bridgeport. It contained 2.30 per cent. of nitrogen and 3.30 per cent. of phosphoric acid. 78 per cent. of the material was in particles coarser than 1-50 inch.

SLAUGHTER HOUSE TANKAGE.

	Nitrogen.			Phosphoric acid.		Mechanical analysis.		
As ammonia.	As organic.	Total found.	Total guaranteed.	Found.	Guaranteed.	Finer than 1-50 inch.	Coarser than 1-50 inch.	Cost per ton.
0.14	5.55	5.69	5.79	16.49	15.00	33.00	67.00	$65.00
0.61	.....	3.95	4.93	4.73	14.00	51.00	49.00	56.50
0.54	2.94	3.48	3.23	22.88	25.42	47.00	53.00	40.00
0.18	3.09	3.27	3.23	22.98	25.42	41.00	59.00	45.00
0.16	4.70	4.86	4.93	10.82	13.73	49.00	51.00	57.00
0.10	7.31	7.57[1]	7.40	9.81	15.00	65.00	35.00	75.50
0.23	5.82	6.05	6.34	14.24	12.20	34.00	66.00	60.49
0.12	7.02	7.14	.....	11.82	......	.....	.....	......
.....	.....	3.23	.....	25.57	......	.....	.....	......
.....	.....	3.92	.....	5.54	......	.....	.....	......
.....	.....	4.46	.....	12.45	......	.....	.....	......
.....	.....	4.23	.....	10.93	......	.....	.....	......
0.30	4.20	4.50	4.84	10.67	12.00	.....	.....	......

MIXED BONE AND TANKAGE.

14866. Listers Celebrated Ground Bone and Tankage Acidulated, made by Listers Agricultural Chemical Works, Newark, N. J. Stock of S. J. Orr, West Suffield; cost $54 per ton.

PERCENTAGE COMPOSITION OF MIXED BONE AND TANKAGE.

Total nitrogen found	2.81
Total nitrogen guaranteed	2.67
Total phosphoric acid found	13.42
Total phosphoric acid guaranteed	12.00

AVERAGE COST OF PLANT FOOD IN FERTILIZER MATERALS

From the foregoing analyses of the various fertilizing materials sold in Connecticut during the present year, the following statement is prepared showing what has been the approximate average cost per pound of nitrogen, phosphoric acid and potash:

TABLE VI. ANALYSES OF

Station No.	Manufacturer and Brand.	Dealer or Purchaser.
	Sampled by Station:	
15056	Am. Agr. Chem. Co., *Fine Ground Bone*..	*Spencer Bros., Suffield*......
15060	Atlantic Packing Co., Fine Bone Meal...	T. H. Eldredge, Norwich....
15062	Berkshire Fertz. Co., Fine Ground Bone..	Manufacturer..............
15057	Bowker Fertz. Co., Fresh Ground Bone..	Israel Andrews, Milldale....
15063	Coe-Mortimer Co., Fine Ground Bone...	Morrison & Dunham, Bethel.
15055	L. T. Frisbie Co., Fine Bone Meal.......	Stanley Svea Coal Co., New]
15064	Lowell Fertz. Co., Ground Bone 2½—26.	S. T. Welden, Simsbury.....
14420	Manchester Rendering Co., Manchester, New Hampshire....................	E. N. Austin, Suffield.......
15061	Pawtucket Ren. Co., Ground Bone.......	Chas. A. Templeton, Inc.,Wat
15065	Piedmont–Mt. Airy Guano Co., Bone Meal	Farmers' Exchange, Woodsto
15058	Rogers & Hubbard Co., Strictly Pure Fine Bone..............................	Joseph Kincaid, Jr., Middleto
15124	Rogers & Hubbard Co., Pure Raw Knuckle Bone Flour........................	Cadwell & Jones, Hartford..
15053	Sanderson Fertz. & Chem. Co., Fine Ground Bone.......................	Manufacturer..............
15054	M. L. Shoemaker, Swift-Sure Bone Meal.	Olds & Whipple, Hartford...
15059	Worcester Rendering Co., Prosperity..... Royal Worcester Ground Steamed Bone	.... G. M. Williams Co., New Lor
	Sampled by Purchaser.	
15209	Armour Fertz. Co., Bone Meal..........	Horace Homer, Cos Cob....
14298	Berkshire Fertz. Co., Bone Meal........	A. T. Henry, Wallingford...
14341	L. T. Frisbie Co., Pure Fine Ground Bone	A. E. Plant Son's Co., Branfo
14396	....	John H. Gasser, Bethel......

		Cents per pound
Nitrogen in nitrates	....	25.6
sulphate of ammonia	....	23.6
cotton seed meal	....	54.5* to 61.2
castor pomace	....	48.6* to 52.8
fish	....	52.5†
Total phosphoric acid in raw ground rock	....	2.7
in "barium-phosphate"	....	6.7 to 7.2
bone	....	6.1§
Available phosphoric acid in precipitated phosphate	..	7.5
basic lime phosphate	....	8.4
acid phosphate	....	10.1
Potash	....	(about) 16.0

* Allowing 7 cents and 12 cents, respectively, for the phosphoric acic and potash contained in it.
† Allowing 10.1 cents per pound for available phosphoric acid.
§ Allowing 50 cents per pound for the nitrogen.

Bone Manures.

Nitrogen.		Phosphoric acid.		Mechanical analysis.		Cost per ton.
Found.	Guaranteed.	Found.	Guaranteed.	Finer than 1-50 inch.	Coarser than 1-50 inch.	
.64	2.47	23.16	22.88	40	60	$58.00
.72	2.05	26.38	25.00	62	38	63.00
.20	3.30	20.24	20.00	46	54	60.00
.59	2.47	26.17	22.88	64	36	61.00
.51	2.47	25.13	22.83	69	31	60.00
.24	2.47	26.02	20.00	48	52	64.00
.32	2.05	24.82	27.00	43	57	52.00
.85	2.50	25.38	26.00	52	48	.....
.98	2.47	21.36	20.00	59	41	65.00
.94	2.47	22.29	20.00	51	49	.....
.67	3.29	23.41	20.59	60	40	73.00
.84	3.82	24.69	24.70	76	24	76.00
.39	2.47	23.67	22.88	45	55	51.50
.72	4.53	24.69	20.00	65	35	70.00
.90	2.47	23.97	20.00	54	46	68.00
.18	....	27.03	.....	47	53	.....
.63	4.11	18.86	.....	..	..	.....
.57	2.47	24.46	20.00	44	56	.....
.04	....	17.49	.....	..	..	60.00

It appears that mineral forms of nitrogen, in nitrates and sulphate of ammonia, have cost only half as much as in most organic forms. There is no question that they are more quickly and completely available than other forms, and under most conditions more economical to use at the present time. Moreover, in comparison with organic forms, they will have to be used in relatively larger amounts in the future. Organic materials, tankage, fish, cotton seed meal, and even bone to a smaller extent, are being used more and more as cattle feeds. Their prices have greatly increased and the supply for fertilizers greatly diminished.

In the brands of mixed fertilizers sold in the State, mineral forms of nitrogen in 1890 made 21.5 per cent. of the total nitrogen; in 1900, 22 per cent.; in 1910, 41 per cent.; and in 1919, 49 per cent.

Other forms of mineral nitrogen, such as nitrate of ammonia, nitrate of lime and phosphate of ammonia, obtained by the fixation of atmospheric nitrogen, will doubtless be put on the market in the near future.

The Stations and the users of fertilizers have the problem of determining which forms of mineral nitrogen are the most convenient and economical for use, mixed or unmixed, on our various crops.

V. MIXED FERTILIZERS.

NITROGENOUS SUPERPHOSPHATES WITHOUT POTASH.

In the following table are analyses of 92 samples, 89 of which were drawn by the Station Agent by the methods prescribed by law.

COMPOSITION AND COST OF THE BRANDS.

4	samples have a guaranty of	.82	per cent. nitrogen.
16	" " " " "	1.65	" "
8	" " " " "	2.47	" "
21	" " " " "	3.25	" "
28	" " " " "	4.11	" "
12	" " "	still higher nitrogen guaranty.	
89			

This year 68% of the brands had 3.25 per cent. or more of nitrogen (equivalent to 4 per cent. ammonia). Last year the percentage was 58. This indicates that in general the brands sold this year have been of higher grade than last year. The National Fertilizer Association has urged on manufacturers the abandonment of low grade brands, and the Station has repeatedly pointed out the false economy of buying "cheap" or low grade goods.

The question for the buyer to decide is not what brands are cheapest, but in what brands available nitrogen, phosphoric acid and potash can be most cheaply bought.

The following average figures are taken from the table of analyses:

GUARANTY. Nitrogen.	Available Phos. acid.	Cost per ton.	With available phos. acid worth 10 cents per lb. nitrogen costs, cents per lb.
0.82	10	$46.00	158.0
1.65	10	48.03	84.9
2.87	10	52.97	66.7
2.57	10	55.65	62.1
3.29	10	58.61	58.7
4.11	8	61.75	55.6

The lowest priced brand, .82-10, sells for $46, and the nitrogen in it costs over $1.50 per pound.

The highest priced brand, 4.11-8, sells for $61.75, but the nitrogen in it costs only about one-third as much as it does in the lowest priced brand.

Guaranties.

Two of the brands examined were deficient in nitrogen, 13 in available phosphoric acid, and 7 in both of these ingredients.

In most cases, however, a deficiency of one ingredient was made up in money equivalent by an overrun of the other ingredient.

Nine samples, however, failed to thus make good the money equivalent by the amounts named below, available phosphoric acid being valued at 10 cents and nitrogen at 50 cents per pound.

15119	A. A. C. Co.'s Special Vegetable Fertilizer	$3.30
15025	Armour's 4-10-0	3.80
14751	Atlantic Packing Co.'s 4-8	1.92
14546	Frisbie's 2-8	1.46
14651	" 5-8	5.62
15078	Lowell Fertz. Co.'s Tobacco 5-6	3.52
15010	Parmenter & Polsey Fertzr. Co.'s Tobacco 5-4	2.18
14945	Piedmont-Mt. Airy Guano Co.'s Brown's Special Fertilizer	6.88
14610	Royster Guano Co.'s Landmark	3.40

Quality of the Nitrogen.

The solubility of the organic nitrogen has been determined in all samples, and in no case was evidence found of the presence of inferior ammoniates.

Analyses Needing Special Notice.

14651. Frisbie's 5-8 was below its guaranteed composition in both nitrogen and "available" phosphoric acid. The firm wrote that it would endeavor to adjust the shortage with the purchaser, and believing that the analysis did not represent the average quality of the goods, asked that another sample be drawn. This was done and analysis No. **15163** of the same brand fully met the guaranty.

14610. Royster's Landmark was also below the guaranteed composition in both nitrogen and "available" phosphoric acid.

The firm asked to have another sample analyzed, but the sampling agent was unable to find it in stock in the state.

TABLE VII. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sa
	Sampled by Station:	
	American Agricultural Chem. Co., New York City.	
14949	Ammoniated Fertilizer A	North Haven
14794	Ammoniated Fertilizer AA	New Canaan
14952	Ammoniated Fertilizer AAA	Southport
14525	Ammoniated Fertilizer AAAA	Southport
14875	Ammoniated Fertilizer AAAA	New Haven
15115	Five Eight Fertilizer	Windsor
15119	*Special Vegetable Fertilizer	Rockville
14862	Tobacco Special	Simsbury
14688	Bradley's Special Corn Phosphate without Potash	Norwich
14689	Bradley's Special Potato Fertz. without Potash	Norwich
	Apothecaries Hall Co., Waterbury, Conn.	
14957	Liberty Corn, Fruit and All Crops	Waterbury
14796	Liberty Market Gardeners' Special	Cheshire
14958	Liberty Potato and Vegetable Special	Waterbury
14747	Liberty Tobacco Special	Windsorville
14858	Liberty Top Dresser for Grass and Grain	Waterbury
	Armour Fertilizer Works, Chrome, N. J.	
15025	*4-10-0	Waterbury
	Atlantic Packing Co., New Haven, Conn.	
14797	Atlantic 2-8	New Britain
14751	*Atlantic 4-8	Norwich
	Berkshire Fertilizer Co., Bridgeport, Conn.	
14873	Economical Grass Fertilizer	Ellington
15024	Grass Special	Chester
14792	Long Island Special	Milford
14590	Tobacco Grower	Ellington
14904	Tobacco Starter	Suffield
	F. E. Boardman, Middletown, Conn.	
14859	Fertilizer for General Crops	Middletown
	Bowker Fertilizer Co., New York City.	
15035	Superphosphate with Ammonia 2%	Watertown
14597	Superphosphate with Ammonia 3%	Milldale
14744	Superphosphate with Ammonia 4%	Milldale
14909	Superphosphate with Ammonia 5%	South Manchestc
14640	Tobacco Grower	Thompsonville

* See note, page 33.

WITHOUT POTASH

Nitrogen.					Phosphoric Acid.							
			Total.					Total.		So-called "Available."		
In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Station No.
0.26	0.37	0.41	1.04	0.82	7.50	3.24	0.82	11.56	11.00	10.74	10.00	**14949**
0.54	0.63	0.87	2.21	1.65	4.27	5.53	1.45	11.25	11.00	9.80	10.00	**14794**
0.85	0.25	1.39	2.67	2.47	5.94	4.30	1.32	11.56	11.00	10.24	10.00	**14952**
0.66	0.86	1.60	3.67	3.29	6.00	3.62	2.85	12.47	11.00	9.62	10.00	**14525**
0.67	0.80	1.58	3.57	3.29	5.89	4.10	2.61	12.60	11.00	9.99	10.00	**14875**
0.12	1.30	1.50	4.50	4.11	4.86	3.75	1.93	10.54	9.00	8.61	8.00	**15115**
1.00	0.04	0.83	3.02	3.29	5.89	3.81	1.39	11.09	11.00	9.70	10.00	**15119**
0.04	0.09	3.03	4.36	4.11	1.08	3.84	0.27	5.19	5.00	4.92	4.00	**14862**
0.45	0.47	0.92	1.84	1.65	5.84	4.40	2.53	12.77	11.00	10.24	10.00	**14688**
0.46	0.18	0.99	1.76	1.65	6.36	3.98	2.53	12.87	11.00	10.34	10.00	**14689**
0.33	0.73	0.84	1.90	1.65	7.23	3.06	1.30	11.59	11.00	10.29	10.00	**14957**
1.67	0.44	1.27	3.38	3.29	8.97	2.54	0.14	11.65	11.00	11.51	10.00	**14796**
1.09	0.67	0.80	2.56	2.47	8.69	2.59	0.78	12.06	11.00	11.28	10.00	**14958**
0.87	0.13	3.13	4.32	4.11	3.06	1.87	0.55	5.48	5.00	4.93	4.00	**14747**
3.02	0.42	1.40	4.96	4.94	6.99	1.83	0.72	9.54	9.00	8.82	8.00	**14858**
1.28	0.33	1.17	2.88	3.29	7.91	2.24	1.18	11.33	10.50	10.15	10.00	**15025**
0.54	0.43	0.59	1.63	1.64	4.38	3.42	0.29	8.09	9.00	7.80	8.00	**14797**
0.98	0.69	1.10	3.34	3.28	3.32	3.42	1.83	8.57	9.00	6.74	8.00	**14751**
0.66	0.45	0.53	7.26	7.40	2.23	3.65	0.61	6.49	8.00	5.88	4.00	**14873**
0.99	1.21	0.47	5.13	5.00	2.69	1.85	0.45	4.99	5.00	4.54	4.00	**15024**
0.18	0.27	1.26	3.51	3.30	3.04	5.43	0.61	9.08	9.00	8.47	8.00	**14792**
0.54	0.31	3.32	4.51	4.11	1.27	3.90	0.13	5.30	4.00	5.17	4.00	**14590**
0.46	0.40	1.38	5.29	5.00	1.37	3.52	0.33	5.22	5.00	4.89	4.00	**14904**
0.58	0.08	1.70	3.61	3.29	3.17	3.86	0.97	8.00	...	7.03	7.00	**14859**
0.20	0.32	0.97	1.71	1.65	5.18	4.85	1.75	11.78	11.00	10.03	10.00	**15035**
.04	0.27	1.50	2.81	2.47	6.46	3.72	1.70	11.88	11.00	10.18	10.00	**14597**
.22	0.09	1.28	3.56	3.29	6.55	3.94	1.19	11.68	11.00	10.49	10.00	**14744**
.07	0.60	1.71	4.27	4.11	8.04	2.69	1.01	11.74	9.00	10.73	8.00	**14909**
0.53	none	3.16	4.41	4.11	1.42	3.88	0.20	5.50	5.00	5.30	4.00	**14640**

TABLE VII. NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sa
	Sampled by Station:	
	E. D. Chittenden Co., Bridgeport, Conn.	
14906	Complete Tobacco & Onion Grower without Potash	Suffield
14908	Tobacco Special without Potash	Enfield
14976	Vegetable and Onion Grower without Potash	Greens Farms
	E. B. Clark Seed Co., Milford, Conn.	
14815	Special Mixture for General Use	Milford
	The Coe-Mortimer Co., New York City.	
14775	Gardeners' and Truckers' Special 1916	Greenwich
14814	High Grade Ammoniated Superphosphate 1916	Milford
14774	Prolific Crop Producer 1916	Greenwich
14973	Tobacco Special	South Windsor
	The Essex Fertilizer Co., Boston, Mass.	
14914	3½-10	Wallingford
15083	Tobacco 5-6	East Granby
	The L. T. Frisbie Co., New Haven, Conn.	
14546	*2-8	New Britain
14913	5-6	Glastonbury
14651	*5-8	East Hartford
15163	5-8	Branford
	The Hubbard Fertilizer Co., Baltimore, Md.	
15044	4-10-0	Ellington
	International Agricultural Corp., Buffalo, N. Y.	
14772	Buffalo Ammoniated Phosphate	Ansonia
14863	Buffalo Three Ten	Tariffville
15128	Buffalo Tobacco Grower	West Suffield
14820	Buffalo Tobacco Special	East Granby
15009	Buffalo Top Dresser and Starter	East Granby
14821	I. A. C. Tobacco Crop	Tariffville
	Lister's Agricultural Chemical Works, Newark, N. J.	
14823	Plant Food 1916	Danbury
14822	Superior Ammoniated Superphosphate 1916	Danbury
	Lowell Fertilizer Co., Boston, Mass.	
15082	3½-10-0	Bloomfield
14943	5-8	Wallingford
15051	Dissolved Bone Fertilizer 2-10	Shelton
15078	*Tobacco 5-6	South Mancheste

*See note, page 33.

WITHOUT POTASH—(*Continued*).

	Nitrogen.				Phosphoric Acid.							
			Total.					Total.		So-called "Available."		
....	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Station No.
01	0.08	0.67	3.13	3.29	9.46	1.38	0.20	11.04	11.00	10.84	10.00	14906
06	0.18	2.09	4.47	4.11	4.14	1.60	0.32	6.06	5.00	5.74	4.00	14908
52	none	0.64	2.49	2.47	7.32	3.38	0.79	11.49	11.00	10.70	10.00	14976
40	0.14	0.84	3.48	3.29	8.15	2.17	0.64	10.96	10.50	10.32	10.00	14815
80	0.37	1.07	4.21	4.11	4.57	3.82	0.87	9.26	9.00	8.39	8.00	14775
06	0.26	1.22	2.54	2.47	6.82	3.87	1.54	12.23	11.00	10.69	10.00	14814
07	0.51	0.95	3.35	3.29	6.78	3.58	1.20	11.56	11.00	10.36	10.00	14774
06	1.29	2.85	4.20	4.11	1.02	4.00	0.15	5.17	5.00	5.02	4.00	14973
18	0.47	1.02	2.80	2.87	6.03	3.83	0.78	10.64	11.00	9.86	10.00	14914
08	0.88	1.72	3.66	4.11	1.77	3.24	2.06	7.07	7.00	5.01	6.00	15083
48	0.59	0.58	1.65	1.65	4.20	3.07	0.37	7.64	9.00	7.27	8.00	14546
07	0.84	1.61	3.61	4.10	2.51	3.23	2.15	7.89	7.00	5.74	6.00	14913
10	0.81	1.50	3.65	4.10	2.93	4.51	2.92	10.36	9.00	7.44	8.00	14651
74	1.82		4.34	4.10	4.85	3.21	0.31	8.37	9.00	8.06	8.00	15163
ne	1.01	0.47	3.07	3.28	9.35	1.96	0.43	11.74	11.00	11.31	10.00	15044
07	0.63	0.51	1.60	1.60	8.63	3.80	1.68	14.11	13.00	12.43	12.00	14772
07	0.76	0.74	2.36	2.50	4.45	6.19	1.33	11.97	11.00	10.64	10.00	14863
ne	0.56	1.50	4.04	4.10	1.69	3.02	0.46	5.17	5.00	4.71	4.00	15128
06	0.21	1.33	3.22	3.30	1.34	2.46	0.90	4.70	4.00	3.80	3.00	14820
91	1.51	1.86	5.65	5.80	4.03	2.54	1.39	7.96	7.00	6.57	6.00	15009
07	0.49	1.33	4.08	4.10	2.53	2.53	1.27	6.33	5.00	5.06	4.00	14821
11	0.38	0.44	0.93	0.82	7.21	3.32	0.93	11.46	11.00	10.53	10.00	14823
26	0.35	0.84	3.51	3.29	7.00	2.95	1.61	11.56	11.00	9.95	10.00	14822
84	0.91	1.03	2.90	2.87	7.20	3.70	2.00	12.90	11.00	10.90	10.00	15082
38	0.91	1.16	4.19	4.10	5.59	3.41	0.70	9.70	9.00	9.00	8.00	14943
62	0.39	0.60	1.77	1.64	4.32	4.64	1.29	10.25	11.00	8.96	10.00	15051
ne	0.92	1.54	3.74	4.10	2.12	2.92	2.12	7.16	6.00	5.04	5.00	15078

TABLE VII. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sar
	Sampled by Station:	
	The Mapes Formula and Peruvian Guano Co., New York City.	
14741	General Crop 1916	Windsor Locks
	National Fertilizer Co., New York City.	
14588	5–4 Tobacco Manure	South Mancheste
14516	Nitrogen Phosphate Mixture No. 1	Guilford
14540	Nitrogen Phosphate Mixture No. 2	Guilford
14652	Nitrogen Phosphate Mixture No. 3	Silver Lane
14740	Nitrogen Phosphate Mixture No. 4	Guilford
	New England Fertilizer Co., Boston, Mass.	
14833	3½–10	Hamden
14643	Tobacco 5–4	Warehouse Point
	Olds & Whipple, Hartford, Conn.	
15148	Grass Fertilizer	Hartford
14840	High Grade Tobacco Starter	Simsbury
15156	High Grade Tobacco Starter	East Windsor Hil
14990	Tobacco Special Fertilizer	Hartford
14709	Tobacco Special Fertilizer	East Windsor Hil
	Parmenter and Polsey Fertilizer Co., Boston, Mass.	
15077	2–10	Plainville
14839	3½–10	Rocky Hill
15010	*Tobacco 5–4	Glastonbury
	Piedmont-Mt. Airy Guano Co., Baltimore, Md.	
14945	*Brown's Special Fertilizer	Woodstock
	F. S. Royster Guano Co., Baltimore, Md.	
14610	*Landmark	Waterbury
14880	Perfecto Tobacco Formula	Granby
14727	Prime Fish Brand	Shelton
15004	Purity	Plantsville
15127	Stevens' Formula	Glastonbury
	Sanderson Fertilizer and Chemical Co., New Haven, Conn.	
14776	High Grade Ammoniated Phosphate	Highwood
14573	Phosphate without Potash	New Haven
14923	Special without Potash	Middlefield
14718	Tobacco Grower	East Hartford
14581	Top Dressing for Grass and Grain wihout Potash	Milford
14635	Top Dressing for Grass and Grain without Potash	Meriden

* See note, page 33.

Nitrogen.					Phosphoric Acid.							
			Total.					Total.		So-called "Available".		
In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Station No.
0.07	0.09	0.72	1.81	1.65	4.73	3.71	2.38	10.82	10.00	8.44	8.00	14741
0.07	0.07	2.78	4.09	4.11	1.08	4.66	0.38	6.12	5.00	5.74	4.00	14588
0.23	0.56	0.37	1.16	0.82	7.65	4.03	0.73	12.41	11.00	11.68	10.00	14516
0.42	0.86	0.74	2.02	1.65	5.80	4.29	1.16	11.25	11.00	10.09	10.00	14540
0.60	0.61	1.59	3.51	2.47	6.12	3.75	2.35	12.22	11.00	9.87	10.00	14652
0.67	0.67	1.63	3.52	3.29	5.72	4.30	2.49	12.51	11.00	10.02	10.00	14740
0.81	0.65	1.29	2.90	2.87	6.71	3.59	2.72	13.02	11.00	10.30	10.00	14833
0.45	0.79	1.52	3.40	4.10	0.86	2.34	1.34	4.54	5.00	3.20	4.00	14643
0.12	0.81	1.74	5.55	4.95	3.42	5.64	0.82	9.88	8.00	9.06	8.00	15148
0.21	0.20	4.59	8.23	8.23	2.28	2.17	0.46	4.91	3.00	4.45	3.00	14840
...	...	...	8.04	8.23	...	...	...	5.65	3.00	...	...	15156
0.11	0.11	3.25	4.33	4.11	2.10	3.14	0.41	5.65	4.00	5.24	4.00	14990
0.11	none	3.63	4.40	4.11	0.73	5.28	0.58	6.59	4.00	6.01	4.00	14709
0.25	0.49	0.64	1.58	1.64	6.85	3.42	1.50	11.77	11.00	10.27	10.00	15077
0.81	0.29	1.68	2.94	2.87	6.84	3.27	2.85	12.96	11.00	10.11	10.00	14839
0.11	0.94	1.56	3.96	4.10	0.63	2.98	1.56	5.17	5.00	3.61	4.00	15010
0.21	0.59	0.61	2.49	3.29	7.07	3.49	1.20	11.76	...	10.56	10.00	14945
1.40	0.25	1.23	3.09	3.29	6.88	2.42	1.54	10.84	10.50	9.30	10.00	14610
0.63	0.07	2.43	3.50	4.11	3.04	1.94	0.41	5.39	4.50	4.98	4.00	14880
0.64	0.03	0.62	1.71	1.65	5.64	2.36	0.88	8.88	8.50	8.00	8.00	14727
0.43	none	0.49	1.00	0.82	4.41	3.70	0.92	9.03	8.50	8.11	8.00	15004
0.75	0.01	2.52	3.72	4.11	2.46	1.85	0.22	4.53	4.50	4.31	4.00	15127
0.66	0.87	1.52	3.61	3.29	5.41	4.45	3.02	12.88	11.00	9.86	10.00	14776
0.43	0.76	0.71	1.90	1.65	5.65	4.17	1.23	11.05	11.00	9.82	10.00	14573
0.23	0.77	1.64	2.64	2.47	7.58	2.30	1.60	11.48	11.00	9.88	10.00	14923
0.08	none	3.60	4.49	4.11	1.51	4.09	0.32	5.92	5.00	5.60	4.00	14718
1.13	0.63	1.76	4.08	4.11	7.19	2.84	1.59	11.62	11.00	10.03	10.00	14581
0.94	0.65	1.65	4.03	4.11	7.40	2.69	1.50	11.59	11.00	10.09	10.00	14635

TABLE VII. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of San
	Sampled by Station:	
	M. S. Shoemaker & Co., Philadelphia, Pa.	
14583	Swift-Sure Superphosphate for Tobacco............	Windsor Locks..
14877	Swift-Sure Superphosphate for Tobacco............	Meriden........
	Virginia-Carolina Chemical Co., New York City.	
15073	Monarch Brand................................	North Haven...
15140	Pawnee Brand.................................	Granby........
	Wilcox Fertilizer Co., Mystic, Conn.	
14722	Grain Fertilizer................................	Mystic.........
	Sampled by Purchasers:	
15052	National Fertilizer Co.'s Tobacco Manure 5-4-0....	Thompsonville: H
14373	Rogers and Hubbard's Climax Tobacco Brand......	Windsor: F. H. '
	Manufacturer's Sample:	
14308	L. T. Frisbie's 2-8..............................	New Haven.....

NITROGENOUS SUPERPHOSPHATES CONTAINING POTAS

In the following table are given 246 analyses of brands beloı ing to this class, 226 of which were sampled by the Station Age The number of brands containing potash is twice as great it was the year before.

Only seven brands contained six per cent. or more but 138 cc tained between three and five per cent. of potash.

COMPOSITION AND COST OF THE BRANDS.

The cost of nitrogen per pound has been calculated in all t brands having the composition given below, allowing 10 ceı per pound for available phosphoric acid and 16 cents per pou for potash.

Formula.	No. of Analyses.	Average cost.	Nitrogen cost per pound.
.82-8-2	7	$50.66	$1.91
1.65-8-2	25	53.06	.93
2.47-8-4	15	62.87	.68
3.29-8-4	21	65.79	.56
4.11-4-3	12	82.96	.80

WITHOUT POTASH—(*Concluded*).

Nitrogen.					Phosphoric Acid.							
			Total.					Total.		So-called "Available".		
In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Station No.
0.99	0.71	1.85	3.55	3.29	3.85	5.18	3.84	12.87	12.00	9.03	10.00	**14583**
1.38	0.52	1.60	3.62	3.29	5.89	4.88	3.34	14.11	12.00	10.77	10.00	**14877**
0.16	0.47	0.95	1.71	1.65	8.76	2.63	1.24	12.63	12.00	11.39	11.00	**15073**
0.58	1.55	1.63	4.04	4.11	3.31	1.07	0.69	5.07	5.00	4.38	4.00	**15140**
0.30	0.19	1.15	1.82	1.64	6.33	3.27	2.60	12.20	11.00	9.60	10.00	**14722**
..	...	...	4.42	...	...	...	...	5.94	...	...	...	**15052**
..	...	...	4.02	4.11	...	...	...	5.87	5.00	...	...	**14373**
..	...	...	1.65	...	...	...	...	9.11	...	...	...	**14308**

Here again it appears that nitrogen in low grade mixtures costs ıre than twice as much as in the higher grades in spite of their newhat lower price and that their purchase is wasteful.

GUARANTIES

Ninety-five out of the 226 analyses do not fully meet their ıranty in every particular. In most cases the deficiency is in ə ingredient only, and is more than made good by an overrun the other two.

In 26 cases there is a deficiency in two or three ingredients, and the following brands this results in a deficiency in money lue.

That is, the value of the amount of plant food guaranteed in a ı of goods, but not supplied, is the sum given in the following tement. For this calculation nitrogen is valued at 50 cents, ailable phosphoric acid 10 cents, and potash at 16 cents per und, respectively, which is about their retail selling price. See ge 56.

TABLE VIII. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampl.
	Sampled by Station:	
	American Agricultural Chemical Co., New York City.	
14611	Double A Tobacco Fertilizer	Suffield
15116	Fish and Potash	Windsor
14786	Grass and Lawn Top Dressing	New London
14947	Grass and Oats Fertilizer	Southington
14953	Monarch Potato Manure	Southport
14692	Sure Growth Phosphate Revised	Thompsonville
14684	Universal Phosphate	New London
15120	Bradley's Alkaline Bone with Potash	Rockville
14951	Bradley's B. D. Guano	North Haven
14686	Bradley's Corn Phosphate	Norwich
15118	Bradley's Half Century Fertilizer Revised	Granby
14793	Bradley's New Method Fertilizer	Norwalk
14518	Bradley's Patent Superphosphate Revised	Hamden
14687	Bradley's Potato Fertilizer	Norwich
14517	Bradley's Potato Manure	Hamden
14693	Bradley's Unicorn	Thompsonville
14980	Bradley's Valley Tobacco Fertilizer	New Milford
15139	Bradley's XL Superphosphate of Lime	Mansfield
15122	East India Black Hawk Potato and Truck Fertz	Gaylordsville
14950	East India Economizer Phosphate	North Haven
15034	East India Mayflower	Watertown
15121	East India Tobacco Fertilizer	Gaylordsville
14954	Great Eastern General	Waterford
15031	Great Eastern North Corn Special 1920	Warehouse Poi
14981	Great Eastern Potato Manure, 1920	New Milford
15046	Packer's Union Animal Corn Fertilizer	Litchfield
14965	Packer's Union Potato Manure 1920	Southington
14791	Quinnipiac Ammoniated Dissolved Phosphate	Milford
14524	Quinnipiac Climax Phosphate	Southport
14657	Quinnipiac Corn Manure	New London
14790	Quinnipiac Phosphate	Milford
14545	Quinnipiac Potato Manure	Southport
14598	Quinnipiac Wrapper Leaf Brand Tobacco Manure Revised	Windsor
15032	Wheeler's Cuban Tobacco Grower	Warehouse Poi
14787	Williams and Clark's Americus H. G. Special Revised	Waterbury
14788	Williams and Clark's Americus Potato Manure	Waterbury
14869	Williams and Clark's Matchless Fertilizer	South Manche
15048	Williams and Clark's Prolific Fertilizer	New Britain
14910	Williams and Clark's Seed Leaf Tobacco Manure Revised	South Manche
	Apothecaries Hall Co., Waterbury, Conn.	
15040	Liberty Market Gardeners' Special	Waterbury
14649	Liberty Tobacco Special	Windsorville

WITH POTASH.

itrogen.				Phosphoric Acid.							Potash.			
		Total.					Total.		So-called "Available."					
water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As muriate.	Total.	Guaranteed.	Station No.
53	1.74	4.48	4.11	0.92	4.35	0.19	5.46	5.00	5.27	4.00	1.50	4.78	5.00	**14611**
43	1.43	2.61	2.47	5.87	4.57	2.48	12.92	11.00	10.44	10.00	2.01	2.01	3.00	**15116**
08	0.73	5.00	4.94	4.62	2.80	1.16	8.58	7.00	7.42	6.00	3.82	3.82	4.00	**14786**
.	..	0.65	..	6.65	5.32	0.86	12.83	13.00	11.97	12.00	0.82	2.44	2.00	**14947**
06	1.56	3.50	3.29	5.41	3.02	1.04	9.47	9.00	8.43	8.00	4.23	4.23	4.00	**14953**
39	0.94	2.55	2.47	4.23	4.97	1.71	10.91	10.00	9.20	9.00	0.45	1.92	2.00	**14692**
02	0.43	1.01	0.82	3.82	4.23	0.93	8.98	9.00	8.05	8.00	1.54	1.79	2.00	**14684**
.	..	..	..	6.37	5.21	0.83	12.41	13.00	11.58	12.00	2.04	2.04	2.00	**15120**
34	0.53	1.22	0.82	5.01	2.73	0.58	8.32	9.00	7.74	8.00	4.81	4.81	4.00	**14951**
50	0.84	1.84	1.65	3.87	4.19	1.56	9.62	9.00	8.06	8.00	1.18	1.91	2.00	**14686**
10	0.99	1.50	1.65	5.44	3.95	1.23	10.62	9.00	9.39	8.00	3.55	3.55	3.00	**15118**
32	0.57	1.09	0.82	4.75	4.02	0.63	9.40	9.00	8.77	8.00	1.82	2.36	2.00	**14793**
54	0.84	2.06	1.65	4.64	4.39	1.27	10.30	10.00	9.03	9.00	1.30	1.30	1.00	**14518**
47	0.62	1.77	1.65	5.04	3.04	1.60	9.68	9.00	8.08	8.00	2.69	2.69	3.00	**14687**
76	1.13	2.42	2.47	3.90	5.20	1.38	10.48	9.00	9.10	8.00	3.06	4.40	4.00	**14517**
38	0.61	1.85	1.65	4.79	3.54	1.55	9.88	9.00	8.33	8.00	2.06	2.06	2.00	**14693**
37	3.04	4.38	4.11	1.91	3.88	0.37	6.16	5.00	5.79	4.00	0.48	2.97	3.00	**14980**
22	0.69	2.65	2.47	3.99	5.33	0.74	10.06	10.00	9.32	9.00	2.33	2.33	2.00	**15139**
77	0.96	2.52	3.29	6.74	3.39	0.49	10.62	9.00	10.13	8.00	5.11	5.11	4.00	**15122**
35	0.84	1.81	0.82	3.94	4.33	1.24	9.51	9.00	8.27	8.00	2.71	2.71	2.00	**14950**
21	0.98	1.89	1.65	6.18	3.30	2.05	11.53	9.00	9.48	8.00	2.24	2.24	2.00	**15034**
56	2.61	4.12	4.11	1.22	4.44	0.33	5.99	5.00	5.66	4.00	0.43	2.87	3.00	**15121**
08	0.32	0.76	0.82	5.46	2.84	0.22	8.52	9.00	8.30	8.00	5.56	5.56	4.00	**14954**
19	1.70	2.42	1.65	4.65	4.42	1.41	10.48	9.00	9.07	8.00	2.04	2.04	2.00	**15031**
25	0.72	1.66	1.65	5.64	2.71	0.78	9.13	9.00	8.35	8.00	3.27	3.27	3.00	**14981**
26	0.74	2.43	2.47	6.14	3.07	0.91	10.12	10.00	9.21	9.00	2.31	2.31	2.00	**15046**
37	0.94	1.79	1.65	5.68	4.58	1.01	11.27	11.00	10.26	10.00	3.99	4.35	4.00	**14965**
10	1.09	1.87	1.65	3.84	4.77	0.82	9.43	9.00	8.61	8.00	1.50	2.19	2.00	**14791**
41	0.86	2.11	0.82	5.55	2.44	1.39	9.38	9.00	7.99	8.00	2.22	2.22	2.00	**14524**
22	0.53	2.00	1.65	4.72	4.05	0.33	9.10	9.00	8.77	8.00	2.67	2.67	2.00	**14657**
15	1.39	2.64	2.47	4.35	5.08	1.28	10.71	10.00	9.43	9.00	0.90	2.02	2.00	**14790**
73	1.26	2.57	2.47	4.11	4.70	1.73	10.54	9.00	8.81	8.00	2.90	3.79	4.00	**14545**
52	2.73	4.37	4.11	0.94	5.47	0.37	6.78	5.00	6.41	4.00	0.65	3.03	3.00	**14598**
01	2.56	4.31	4.11	1.15	4.19	0.54	5.88	5.00	5.34	4.00	0.58	5.10	5.00	**15032**
54	0.68	3.43	3.29	5.54	3.00	1.02	9.56	9.00	8.54	8.00	3.87	3.87	4.00	**14787**
29	0.97	1.95	1.65	2.36	6.31	1.30	9.97	9.00	8.67	8.00	1.82	2.96	3.00	**14788**
58	1.53	3.24	1.65	5.02	3.99	1.83	10.84	9.00	9.01	8.00	2.00	2.00	2.00	**14869**
27	0.69	1.44	0.82	4.36	3.70	1.05	9.11	8.00	8.06	7.00	0.68	1.80	1.00	**15048**
32	2.34	4.27	4.11	0.36	5.40	0.12	5.88	5.00	5.76	4.00	1.22	3.29	3.00	**14910**
57	1.67	3.53	3.29	5.30	2.93	0.97	9.20	9.00	8.23	8.00	3.58	3.58	4.00	**15040**
31	3.07	4.29	4.11	2.85	1.72	0.43	5.00	5.00	4.57	4.00	0.31	2.41	3.00	**14649**

TABLE VIII. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Samp
	Sampled by Station:	
	Armour Fertilizer Works, Chrome, N. J.	
14750	Cereal Special No. 1	New Haven..
14944	Complete Potato Fertilizer	Rockville.....
14907	Gardeners' Choice Fertilizer	Thompsonvill
14710	General Crop Fertilizer	New Haven..
14694	Grain Grower Fertilizer	New Haven..
14683	Potato, Onion and Vegetable Fertilizer	New London.
14912	Super-Grade Potato Mixture Fertilizer	Rockville....
15160	Tobacco Special Fertilizer	South Manche
14748	*Wheat and Clover Fertilizer	New Haven..
15033	Bidwell's Formula	Windsor Lock
	Atlantic Packing Co., New Haven, Conn.	
14860	3-8-3	New Britain.
14690	*Grain Fertilizer	Willimantic..
14685	Potato Phosphate 3-8-4	Norwich.....
14861	Special Vegetable	New Britain.
15050	*Tobacco Grower	Hockanum..
14691	Tobacco Special	East Hartford
	Berkshire Fertilizer Co., Bridgeport, Conn.	
14789	Ammoniated Bone Phosphate	Waterbury..
14647	Complete Fertilizer	Ellington....
14650	Complete Tobacco	Hazardville..
14743	Market Garden Fertilizer	Ellington....
14591	Potato and Vegetable Phosphate	Ellington....
	Bowker Fertilizer Co., New York City.	
14594	All Round Fertilizer	Hazardville..
14641	Connecticut Valley Tobacco Fertilizer	Thompsonvill
14655	Corn, Grain and Grass Phosphate	New London.
14593	Fisherman's Brand Fish and Potash	Hazardville..
14615	Hill and Drill Phosphate	Hazardville..
14843	Lawn and Garden Dressing Revised	New Haven..
14703	Potato and Vegetable Phosphate	Norwich.....
14638	Square Brand Farm and Garden Phosphate	Milldale.....
14656	Sure Crop Phosphate Revised	New London.
15080	Stockbridge Complete	Uncasville...
14619	Stockbridge Market Garden Manure	Milldale.....
15126	Stockbridge Tobacco Manure	Granby.....
	E. D. Chittenden Co., Bridgeport, Conn.	
15110	†Complete Tobacco and Onion Grower	Suffield......
14905	Tobacco Special with 5% Potash	Suffield......

*See note, page 56. †See note, page 57.

WITH POTASH—(*Continued*).

itrogen.				Phosphoric Acid.							Potash.			
		Total.					Total.		So-called "Available."					
water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	*Found.*	Guaranteed.	Found.	Guaranteed.	As muriate.	Total.	*Guaranteed.*	*Station No.*
42	0.64	1.50	1.65	8.23	1.95	0.90	11.08	10.50	10.18	10.00	6.55	6.55	6.00	**14750**
04	0.73	1.71	1.65	6.76	1.72	0.59	9.07	8.50	8.48	8.00	3.90	3.90	4.00	**14944**
45	0.91	2.42	2.47	6.16	2.37	0.96	9.49	8.50	8.53	8.00	3.84	3.84	4.00	**14907**
me	0.26	0.93	0.82	5.77	1.60	0.27	7.64	7.50	7.37	7.00	1.05	1.05	1.00	**14710**
08	0.43	1.71	1.65	5.64	2.19	0.73	8.56	8.50	7.83	8.00	1.88	1.88	2.00	**14694**
42	0.59	3.31	3.29	6.22	2.11	0.52	8.85	8.50	8.33	8.00	3.71	3.71	4.00	**14683**
60	1.07	4.12	4.11	6.54	1.95	0.90	9.39	8.50	8.49	8.00	4.83	4.83	5.00	**14912**
22	3.01	4.08	4.11	2.78	2.24	0.23	5.25	4.50	5.02	4.00	0.31	3.11	3.00	**15160**
.	..	0.22	..	7.91	1.18	0.36	9.45	10.50	9.09	10.00	3.88	3.88	5.00	**14748**
09	1.11	2.62	2.47	6.94	1.30	0.29	8.53	8.50	8.24	8.00	0.20	4.87	5.00	**15033**
57	0.91	2.49	2.40	4.43	3.77	0.63	8.83	9.00	8.20	8.00	3.12	3.12	3.00	**14860**
32	0.56	1.44	1.64	4.34	2.79	0.47	7.60	9.00	7.13	8.00	2.06	2.06	2.00	**14690**
58	0.82	2.47	2.46	5.00	3.44	0.59	*9.03*	*9.00*	*8.44*	*8.00*	*4.02*	*4.02*	*4.00*	**14685**
19	1.03	3.18	3.28	4.46	3.91	0.92	9.29	9.00	8.37	8.00	3.91	3.91	4.00	**14861**
81	1.45	3.84	4.10	0.67	3.30	2.43	6.40	6.00	3.97	5.00	0.96	4.48	4.00	**15050**
75	1.94	4.14	4.10	1.70	3.18	2.23	7.11	6.00	4.88	5.00	0.78	1.97	2.00	**14691**
me	0.30	1.09	0.80	6.61	3.83	0.40	10.84	11.00	10.44	10.00	2.10	2.10	2.00	**14789**
17	1.42	2.81	2.50	4.35	3.66	1.41	9.42	9.00	8.01	8.00	3.22	3.22	3.00	**14647**
81	2.26	4.26	4.11	0.76	4.02	0.41	5.19	4.00	4.78	4.00	1.59	4.06	4.00	**14650**
14	1.77	3.30	3.30	1.72	5.86	1.54	9.12	9.00	7.58	8.00	3.93	3.93	4.00	**14743**
12	1.04	1.84	1.70	6.79	3.85	1.16	11.80	9.00	10.64	8.00	2.29	2.29	2.00	**14591**
62	1.28	2.59	2.47	3.54	5.12	1.41	10.07	9.00	8.66	8.00	4.19	4.19	4.00	**14594**
55	*2.71*	*4.52*	*4.11*	*0.94*	*4.37*	*0.23*	*5.54*	*5.00*	*5.31*	*4.00*	*0.76*	*3.00*	*3.00*	**14641**
23	0.56	1.91	1.65	4.97	3.66	0.82	9.45	9.00	8.63	8.00	2.03	2.29	2.00	**14655**
09	0.98	2.51	2.47	5.35	4.90	1.07	11.32	11.00	10.25	10.00	3.02	3.02	3.00	**14593**
68	0.77	2.64	2.47	2.45	6.61	1.37	10.43	10.00	9.06	9.00	0.57	1.93	2.00	**14615**
18	1.34	2.64	2.47	4.25	5.16	1.32	10.73	10.00	9.41	9.00	0.88	2.07	2.00	**14843**
19	0.95	1.82	1.65	3.38	5.15	1.65	10.18	9.00	8.53	8.00	3.37	3.37	3.00	**14703**
23	0.98	1.91	1.65	3.31	4.96	0.95	9.22	9.00	8.27	8.00	1.21	2.12	2.00	**14638**
me	0.38	0.93	0.82	3.61	3.97	0.90	8.48	9.00	7.58	8.00	1.71	1.99	2.00	**14656**
12	1.34	4.09	4.11	4.40	3.94	0.50	8.84	9.00	8.34	8.00	4.26	4.26	4.00	**15080**
36	0.72	3.30	3.29	4.16	4.04	1.13	9.33	9.00	8.20	8.00	3.95	3.95	4.00	**14619**
55	2.84	4.48	4.11	0.82	4.80	0.55	6.17	5.00	5.62	4.00	0.58	4.57	5.00	**15126**
16	0.57	3.29	3.29	4.15	3.84	0.61	8.60	9.00	7.99	8.00	4.06	4.06	4.00	**15110**
24	*1.67*	*4.30*	*4.11*	*3.29*	2.73	0.40	6.42	*5.00*	6.02	4.00	0.51	4.76	5.00	**14905**

TABLE VIII. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampli
	Sampled by Station:	
	Everett B. Clark Seed Co., Milford, Conn.	
14802	Special Mixture with Potash	Orange
	The Coe-Mortimer Co., New York City.	
14745	Celebrated Special Potato Fertz. Revised	Poquonock
14599	Columbian Corn and Potato Fertilizer	Poquonock
14915	Corn King	Abington
14639	Connecticut Wrapper Grower	Poquonock
15081	Dissolved Phosphate and Potash	Gilead
14654	Gold Brand Excelsior Guano Revised	Wethersfield
14700	New Englander Special	Poquonock
15026	Special Grass Top Dressing	Plantsville
14972	Tobacco Leaf Fertilizer	Glastonbury
	Columbia Guano Co., Baltimore, Md.	
15030	*†Freedom Guano	Melrose
15029	Soluble Guano	Melrose
	Essex Fertilizer Co., Boston, Mass.	
14704	Fish Fertilizer 3-8-3	South Manches
14705	Market Garden 3-8-4	South Manches
15027	*Tobacco 5-5-4	Hartford
14746	1-10-1	South Manches
14874	*2-8-2	South Manches
15028	*4-8-4	Broad Brook
15005	5-7-2	Weatogue
	L. T. Frisbie Co., New Haven, Conn.	
15109	Complete Manure	Simsbury
14582	*Corn and Grain Fertz. 2-8-2	New Britain
14539	Special	Guilford
14595	Special Vegetable and Potato Grower 4-8-4	North Haven
14882	Special Vegetable and Potato Grower 4-8-4	Milford
14948	Tobacco Grower	Silver Lane
14911	*Tobacco Special	Rockville
14658	*Tobacco 5-5-5	East Hartford
14620	3-8-3	Plantsville
	Hubbard Fertilizer Co., Baltimore, Md.	
15043	*‡Noxall Guano	Ellington
	International Agricultural Corporation, Buffalo, N. Y.	
14773	Buffalo Economy	Ansonia
15014	Buffalo Farmers' Choice	Ellington
15007	Buffalo General Favorite	East Granby

*See note, page 56. †See note, page 57. ‡See note,

WITH POTASH—(*Continued*)

itrogen.				Phosphoric Acid.							Potash.			
water-soluble.	Organic, water-insoluble.	Total.		Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total.		So-called "Available."		As muriate.	Total.	Guaranteed.	Station No.
		Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.				
13	0.85	3.66	3.29	8.08	2.05	0.72	10.85	...	10.13	10.00	3.31	3.31	3.00	14802
63	1.23	3.32	3.29	3.88	5.07	1.22	10.17	9.00	8.95	8.00	3.87	4.10	4.00	14745
18	0.82	1.48	1.65	3.74	5.02	1.36	10.12	9.00	8.76	8.00	2.91	2.91	3.00	14599
41	1.01	2.60	2.47	5.51	3.48	1.83	10.82	10.00	8.99	9.00	2.33	2.33	2.00	14915
53	2.54	4.14	4.11	0.82	4.49	0.31	5.62	5.00	5.31	4.00	1.50	4.94	5.00	14639
.	. .	. .	. .	7.69	4.50	0.32	12.51	13.00	12.19	12.00	2.11	2.11	2.00	15081
38	1.03	2.64	2.47	2.84	5.65	1.27	9.76	9.00	8.49	8.00	0.84	3.83	4.00	14654
02	0.76	1.00	0.82	4.33	4.66	0.87	9.86	9.00	8.99	8.00	2.08	2.08	2.00	14700
32	1.13	5.28	4.94	3.40	3.18	0.37	6.95	7.00	6.58	6.00	3.88	3.88	4.00	15026
60	2.61	4.28	4.11	0.62	4.86	0.14	5.62	5.00	5.48	4.00	0.80	3.09	3.00	14972
25	1.07	3.16	3.30	5.00	2.68	1.52	9.20	8.50	7.68	8.00	3.74	3.74	4.00	15030
15	0.60	1.69	1.65	5.05	2.62	1.39	9.06	8.50	7.67	8.00	1.83	1.83	2.00	15029
53	0.78	2.54	2.47	5.42	3.13	1.25	9.80	9.00	8.55	8.00	2.96	2.96	3.00	14704
56	0.67	2.31	2.46	6.39	1.79	0.61	8.79	9.00	8.18	8.00	3.99	3.99	4.00	14705
85	1.81	4.02	4.10	1.62	3.40	2.14	7.16	6.00	5.02	5.00	0.82	3.83	4.00	15027
53	0.40	1.02	0.82	7.47	2.89	1.27	11.63	11.00	10.36	10.00	1.20	1.20	1.00	14746
50	0.67	1.64	1.64	3.75	3.93	1.15	8.83	9.00	7.68	8.00	1.55	1.84	2.00	14874
56	0.82	3.04	3.29	4.78	3.48	0.45	8.71	9.00	8.26	8.00	3.88	3.88	4.00	15028
00	1.60	4.00	4.10	3.03	3.83	2.16	9.02	8.00	6.86	7.00	0.84	2.04	2.00	15005
55	1.10	3.13	3.29	3.55	4.17	0.95	8.67	9.00	7.72	8.00	6.42	6.42	6.00	15109
46	0.54	1.43	1.65	2.93	3.98	0.46	7.37	9.00	6.91	8.00	2.10	2.10	2.00	14582
54	0.78	2.37	2.46	4.95	3.34	0.58	8.87	9.00	8.29	8.00	4.00	4.00	4.00	14539
76	0.89	3.37	3.28	3.94	3.42	1.25	8.61	9.00	7.36	8.00	4.35	4.35	4.00	14595
59	0.99	3.52	3.28	4.28	3.92	1.01	9.21	9.00	8.20	8.00	3.80	3.80	4.00	14882
6	1.67	4.07	4.10	1.17	3.72	2.53	7.42	6.00	4.89	5.00	1.04	3.98	4.00	14948
3	1.64	3.83	4.10	1.35	3.53	2.46	7.34	6.00	4.88	5.00	0.92	1.79	2.00	14911
1	1.97	3.80	4.10	1.78	2.77	1.87	6.42	6.00	4.55	5.00	0.73	5.47	5.00	14658
1	0.78	2.47	2.46	4.52	3.76	1.30	9.58	9.00	8.28	8.00	3.14	3.14	3.00	14620
0	0.67	3.07	3.28	5.34	3.21	0.24	8.79	9.00	8.55	8.00	1.14	3.81	4.00	15043
2	0.63	1.63	1.60	5.45	2.72	1.36	9.53	9.00	8.17	8.00	2.20	2.20	2.00	14773
2	0.39	1.26	0.80	5.92	4.62	1.34	11.88	11.00	10.54	10.00	2.35	2.35	2.00	15014
5	0.52	1.18	0.80	5.20	4.63	0.99	10.82	9.00	9.83	8.00	0.70	1.29	1.00	15007

TABLE VIII. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampli
	Sampled by Station:	
	International Agricultural Corporation, Buffalo, N. Y. (*Continued*)	
15079	Buffalo High Grade Manure........................	East Haven....
15006	Buffalo New England Special........................	Tariffville.....
14711	Buffalo Onion, Vegetable and Potato................	Shelton.......
15008	Buffalo Tobacco Producer...........................	East Granby...
	A. L. Koster, Suffield, Conn.	
14974	Hale Tobacco Mixture............................	Windsor Locks.
	Lister's Agricultural Chemical Works, Newark, N. J.	
14864	Celebrated Tobacco Fertilizer........................	Burnside......
14865	*Complete Tobacco Manure........................	Burnside......
14970	Corn and Potato Fertilizer...........................	Glastonbury...
15011	Eastern Pride Fertilizer............................	Rockville......
15111	King Bee Fertilizer..............................	Yalesville.....
15112	Special Crop Producer...........................	Yalesville.....
14979	Special Tobacco Fertilizer..........................	Brookfield.....
14824	Standard Pure Superphosphate of Lime..............	Burnside......
15047	Success Fertilizer...............................	East Canaan...
	Lowell Fertilizer Co., Boston, Mass.	
14520	Animal Brand 3-8-4..............................	Southington...
14543	Bone Fertilizer 2-8-2.............................	Southington...
14522	Empress Brand 1-10-1............................	New Britain...
15049	*Lawn and Garden Dressing........................	Hartford......
14706	Tobacco 5-5-4................................	Warehouse Poi
14819	Tobacco 5-7-2................................	Granby.......
14702	2-8-3......................................	Saybrook......
14975	4-8-4......................................	Westport......
14817	*5-8-4.....................................	Wethersfield...
	Mapes' Formula and Peruvian Guano Co., New York City.	
14548	Corn Manure..................................	Windsor Locks.
14614	C. S. Tobacco Manure...........................	Rockville......
14701	General Tobacco Manure..........................	Hartford......
14742	†General Truck Manure..........................	Windsor Locks.
15013	*Grain Brand.................................	Rockville......
14527	Potato Manure................................	Windsor Locks.
14653	†Potato Manure, 1916 Brand......................	Glastonbury...
14584	Tobacco Starter Improved........................	Windsor Locks.

* See note, page 56. †See note, page 59.

WITH POTASH—(*Continued*).

...trogen.				Phosphoric Acid.							Potash.			
		Total.					Total.		So-called "Available."					
...water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As muriate.	Total.	Guaranteed.	Station No.
)3	1.12	3.13	3.30	3.76	4.77	1.64	10.17	9.00	8.53	8.00	3.61	4.30	4.00	**15079**
)5	0.72	1.92	1.60	5.42	4.86	1.45	11.73	11.00	10.28	10.00	3.59	3.82	4.00	**15006**
;1	0.77	2.42	2.50	5.86	2.68	1.46	10.00	9.00	8.54	8.00	3.07	3.07	3.00	**14711**
'5	1.24	4.26	4.10	0.89	3.61	1.45	5.95	5.00	4.50	4.00	0.94	2.11	2.00	**15008**
;6	2.80	5.10	4.94	1.06	5.76	1.15	7.97	...	6.82	5.00	2.18	4.81	4.00	**14974**
ıe	3.24	4.06	4.11	2.28	3.57	0.33	6.18	5.00	5.85	4.00	1.04	2.85	3.00	**14864**
19	0.61	4.12	4.11	1.84	2.42	1.15	5.41	5.00	4.26	4.00	4.33	4.33	5.00	**14865**
'6	0.68	1.70	1.65	3.62	4.06	2.06	9.74	9.00	7.68	8.00	2.79	2.79	3.00	**14970**
'6	0.59	2.47	2.47	6.41	2.02	1.43	9.86	9.00	8.43	8.00	3.76	3.76	4.00	**15011**
;1	0.53	1.80	1.65	5.21	3.36	1.74	10.31	11.00	8.57	10.00	5.63	5.63	4.00	**15111**
!6	0.44	0.92	0.82	4.61	2.82	0.73	8.16	8.00	7.43	7.00	0.51	2.16	1.00	**15112**
;5	0.72	1.87	1.65	7.10	2.93	2.12	12.15	11.00	10.03	10.00	3.66	3.66	4.00	**14979**
;6	0.58	2.52	2.47	4.57	4.43	1.52	10.52	10.00	9.00	9.00	0.62	1.90	2.00	**14824**
!4	0.49	1.85	1.65	7.78	1.48	0.50	9.76	9.00	9.26	8.00	1.86	1.86	2.00	**15047**
!2	0.71	2.92	2.46	6.12	2.44	0.83	9.39	9.00	8.56	8.00	3.58	3.58	4.00	**14520**
;7	0.85	1.78	1.64	3.89	3.95	1.37	9.21	9.00	7.84	8.00	1.74	2.03	2.00	**14543**
;9	0.54	1.37	0.82	6.89	3.21	0.90	11.00	11.00	10.10	10.00	1.96	1.96	1.00	**14522**
).14		3.14	3.28	5.62	1.50	1.73	8.85	8.00	7.12	7.00	1.88	1.88	2.00	**15049**
2	1.72	4.15	4.10	1.49	3.08	2.15	6.72	6.00	4.57	5.00	0.90	4.22	4.00	**14706**
)6	1.85	4.19	4.10	2.63	4.14	1.87	8.64	8.00	6.77	7.00	0.70	1.98	2.00	**14819**
;9	0.65	1.73	1.64	5.63	2.97	1.05	9.65	9.00	8.60	8.00	3.15	3.15	3.00	**14702**
;1	0.79	3.25	3.28	3.79	4.29	0.96	9.04	9.00	8.08	8.00	3.98	3.98	4.00	**14975**
;8	0.91	3.61	4.10	5.23	3.11	1.20	9.54	9.00	8.34	8.00	3.78	3.78	4.00	**14817**
.8	0.90	2.57	2.47	3.58	3.74	2.94	10.26	10.00	7.32	8.00	3.33	3.33	3.00	**14548**
;5	2.07	4.25	4.12	0.49	4.38	1.25	6.12	4.00	4.87	4.00	0.70	1.45	1.00	**14614**
)0	2.11	4.39	4.12	0.41	4.59	0.28	5.28	4.00	5.00	4.00	1.30	5.41	5.00	**14701**
)4	1.40	4.50	4.12	2.05	4.20	1.92	8.17	8.00	6.25	6.00	5.13	5.13	5.00	**14742**
.5	0.57	1.72	1.65	1.65	4.85	3.99	10.49	10.00	6.50	8.00	1.99	1.99	2.00	**15013**
1	0.45	3.68	3.71	3.75	3.29	1.61	8.65	8.00	7.04	7.00	4.91	4.91	5.00	**14527**
)3	0.28	3.71	3.71	4.25	2.75	0.96	7.96	8.00	7.00	8.00	0.65	1.53	1.00	**14653**
.6	1.77	4.55	4.12	1.82	4.27	3.67	9.76	8.00	6.09	6.00	0.54	1.50	1.00	**14584**

TABLE VIII. NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Samp
	Sampled by Station:	
	National Fertilizer Co., New York City.	
14818	Complete Tobacco Fertilizer	Simsbury
14575	Eureka Potato Fertilizer	West Cheshire
14589	Market Garden Fertilizer Revised	South Manche
14596	Potato Phosphate	Meriden
14708	Soluble Bone and Potash	Somersville
14921	Special Tobacco, Revised	Hartford
14612	Universal Phosphate	South Manche
14541	XXX Fish and Potash	West Cheshire
	New England Fertilizer Co., Boston, Mass.	
14648	*Corn Phosphate 2-8-2	Rockville
14592	Standard Phosphate 1-10-1	Rockville
14816	Superphosphate 3-8-4	Hamden
14832	Tobacco 5-5-4	Warehouse Po
14526	2-8-3	Meriden
14876	2-8-3	East Wallingfc
14547	3-8-3	Meriden
	Olds & Whipple, Hartford, Conn.	
14841	Complete Corn, Potato and Onion Fertilizer	Simsbury
14766	Complete Tobacco Fertilizer	Hazardville
14991	Complete Tobacco Fertilizer	Scitico
15155	Complete Tobacco Fertilizer	East Windsor
14842	Special Corn, Onion and Potato Fertilizer	Simsbury
	Parmenter & Polsey, Boston, Mass.	
14767	Plymouth Rock 3-8-4	Plantsville
15151	Tobacco 5-5-4	Bloomfield
15107	1-10-1	Plantsville
14964	*2-8-2	West Hartford
	Pawtucket Rendering Co., Pawtucket, R. I.	
14959	2-8-2	Brooklyn
	Piedmont-Mt. Airy Guano Co., Baltimore, Md.	
14856	*Brown's H. G. Potato and Gen. Crop Manure	South Meriden
14871	Brown's Potato Fertilizer	South Meriden
14857	Brown's Special O. & T. Dresser and Market Garden	Meriden
14963	*Shay's Corn Fertilizer	Chester
14962	*Shay's Potato Fertilizer	Groton
14961	Shay's Special Fertilizer	Groton
	Quality Fertilizer Works, Stamford, Conn.	
15208	Bartlett Brand Special Tree Fertilizer	Stamford

*See note, page 56.

WITH POTASH—(*Continued*).

Nitrogen.				Phosphoric Acid.							Potash.			
		Total.					Total.		So-called "Available."					
…water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As muriate.	Total.	Guaranteed.	Station No.
66	2.65	4.24	4.11	0.90	4.84	0.36	6.10	5.00	5.74	4.00	0.82	4.41	5.00	**14818**
64	0.94	3.51	3.29	0.13	7.84	1.68	9.65	9.00	7.97	8.00	0.74	4.08	4.00	**14575**
60	1.19	2.44	2.47	3.92	5.14	1.33	10.39	9.00	9.06	8.00	3.39	4.24	4.00	**14589**
22	0.98	1.85	1.65	3.87	4.72	1.39	9.98	9.00	8.59	8.00	3.29	3.29	3.00	**14596**
.	..	..	..	7.10	4.68	0.90	12.68	13.00	11.78	12.00	2.05	2.05	2.00	**14708**
65	2.62	4.33	4.11	0.54	4.85	0.14	5.53	5.00	5.39	4.00	0.90	3.17	3.00	**14921**
25	0.59	1.03	0.82	5.15	3.13	0.99	9.27	9.00	8.28	8.00	2.02	2.02	2.00	**14612**
25	0.73	2.64	2.47	4.74	5.31	1.20	11.25	11.00	10.05	10.00	0.93	2.88	3.00	**14541**
62	0.73	1.65	1.64	3.55	3.75	1.41	8.71	9.00	7.30	8.00	1.49	1.84	2.00	**14648**
35	0.48	1.04	0.82	7.48	3.35	1.05	11.88	11.00	10.83	10.00	1.12	1.12	1.00	**14592**
69	0.73	2.54	2.46	5.64	2.48	0.68	8.80	9.00	8.12	8.00	3.57	3.57	4.00	**14816**
89	1.90	4.31	4.10	1.28	3.27	1.97	6.52	6.00	4.55	5.00	0.90	3.65	4.00	**14832**
49	0.57	1.66	1.64	5.56	2.83	0.82	9.21	9.00	8.39	8.00	2.83	2.83	3.00	**14526**
32	0.58	1.59	1.64	5.31	3.19	0.81	9.31	9.00	8.50	8.00	3.04	3.04	3.00	**14876**
65	0.77	2.50	2.46	5.21	2.76	1.46	9.43	9.00	7.97	8.00	2.83	2.83	3.00	**14547**
65	1.66	3.37	3.30	2.06	5.60	1.32	8.98	8.00	7.66	8.00	4.98	4.98	4.00	**14841**
58	3.19	4.37	4.11	0.57	4.20	0.65	5.42	4.00	4.77	4.00	0.90	4.52	4.00	**14766**
44	3.15	4.38	4.11	0.71	4.03	0.22	4.96	4.00	4.74	4.00	0.56	4.29	4.00	**14991**
.	..	4.30	4.11	..	..	..	4.84	4.00	...	...	..	4.07	4.00	**15155**
55	0.92	2.45	2.45	2.83	5.61	1.60	10.04	8.00	8.44	8.00	2.69	2.69	2.00	**14842**
54	0.77	2.67	2.46	5.54	2.49	0.69	8.72	9.00	8.03	8.00	4.13	4.13	4.00	**14767**
96	1.73	4.22	4.10	0.49	5.14	1.78	7.41	6.00	5.63	5.00	0.98	3.92	4.00	**15151**
30	0.45	0.92	0.82	6.88	3.50	1.11	11.49	11.00	10.38	10.00	1.03	1.03	1.00	**15107**
54	0.63	1.81	1.64	2.30	3.98	1.43	7.71	9.00	6.28	8.00	2.02	2.02	2.00	**14964**
27	0.96	1.77	1.64	5.77	3.19	0.47	9.43	8.00	8.96	7.00	2.35	2.35	2.00	**14959**
60	1.20	2.92	3.29	4.37	3.34	0.86	8.57	...	7.71	8.00	4.00	4.00	4.00	**14856**
58	1.56	2.90	2.47	6.10	3.23	1.48	10.81	...	9.33	8.00	3.53	3.53	4.00	**14871**
71	1.47	2.95	4.53	6.07	3.38	1.50	10.95	...	9.45	8.00	3.50	3.50	3.00	**14857**
12	0.85	2.07	2.47	6.06	1.93	0.68	8.67	...	7.99	8.00	2.99	2.99	3.00	**14963**
42	1.01	2.73	3.29	5.09	2.73	0.84	8.66	...	7.82	8.00	4.18	4.18	4.00	**14962**
54	0.54	1.40	1.65	5.15	2.99	0.97	9.11	...	8.14	8.00	2.60	2.60	2.00	**14961**
53	0.68	3.35	4.00	6.05	2.24	0.60	8.89	8.50	8.29	8.00	3.95	3.95	4.00	**15208**

TABLE VIII. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Samp
	Sampled by Station:	
	Rogers and Hubbard Co., Middletown, Conn.	
14924	Hubbard's Bone Base Fertilizer for Seeding Down	Newington
14616	Hubbard's Bone Base Oats and Top Dressing	Hazardville
14883	*Hubbard's Bone Base Oats and Top Dressing	Hamden
14716	Hubbard's Bone Base Soluble Corn and General Crop Manure	Hazardville
14884	Hubbard's Bone Base Soluble Potato Manure	Hamden
14617	Hubbard's Bone Base Soluble Potato Manure	Hazardville
14834	R. and H. All Soils-All Crops Phosphate	Hamden
15015	R. and H. Climax Tobacco Brand	Glastonbury
14719	R. and H. Complete Phosphate	Middletown
14726	R. and H. Potato Phosphate	Hazardville
14838	R. and H. Soluble Tobacco Manure	Gildersleeve
14837	R. and H. Tobacco Grower, Vegetable Formula	Gildersleeve
	F. S. Royster Guano Co., Baltimore, Md.	
14777	Arrow Head Tobacco Formula	New Milford
14946	Banner Guano	Putnam
14544	†Bully Guano	Waterbury
14867	Dreadnought Guano	Naugatuck
14771	‡Fish, Flesh and Fowl Guano	Shelton
15358	Fish, Flesh and Fowl Guano	Branford
14578	Fish and Potash	Waterbury
14927	†Quality Trucker	Putnam
14868	†Truckers' Delight	Glastonbury
14878	Valley Tobacco Formula	Glastonbury
	Sanderson Fertilizer and Chemical Co., New Haven, Conn.	
14637	Atlantic Coast Bone, Fish and Potash	Meriden
14768	Complete Tobacco Grower	Glastonbury
14634	Corn Superphosphate	Meriden
14720	Formula "A"	Guilford
15129	Formula "B"	Milford
14580	Potato Manure	Milford
14636	Potato Manure	Meriden
14925	Top Dressing for Grass and Grain	Glastonbury
14917	South American Sheep and Goat Manure	New Canaan
14922	Kelsey's Bone, Fish and Potash	Clinton
	M. L. Shoemaker and Co., Philadelphia, Pa.	
14835	Swift-Sure Superphosphate for General Use	Meriden
14836	Swift-Sure Superphosphate for Potatoes No. 1	Meriden

WITH POTASH—(*Continued*).

rogen.				Phosphoric Acid.							Potash.			
		Total.					Total.		So-called "Available."					
	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As muriate.	Total.	Guaranteed.	Station No.
4	2.17	2.78	2.46	0.08	7.75	8.26	16.09	15.00	7.83	6.00	4.35	4.35	4.00	14924
4	0.88	8.04	8.22	0.54	4.92	2.92	8.38	8.00	5.46	3.00	4.00	4.00	4.00	14616
7	1.21	8.24	8.22	0.07	5.06	2.37	7.50	8.00	5.13	3.00	4.50	4.50	4.00	14883
4	0.51	2.33	2.46	1.69	7.07	1.82	10.58	10.00	8.76	8.00	4.49	4.49	4.00	14716
8	0.61	4.29	4.11	1.64	6.71	1.48	9.83	10.00	8.35	8.00	1.22	6.27	6.00	14884
8	0.78	3.96	4.11	0.12	8.49	2.75	11.36	10.00	8.61	8.00	1.57	5.94	6.00	14617
5	0.58	3.07	3.29	3.28	5.56	1.43	10.27	9.00	8.84	8.00	6.50	6.50	6.00	14834
1	1.63	4.31	4.11	0.76	2.90	2.19	5.85	5.00	3.66	4.00	0.78	2.96	3.00	15015
1	0.36	0.80	0.82	4.19	4.69	1.42	10.30	9.00	8.88	8.00	2.14	2.14	2.00	14719
3	0.50	1.63	1.64	3.23	5.47	1.30	10.00	9.00	8.70	8.00	4.35	4.35	4.00	14726
6	1.70	4.76	4.93	1.17	7.70	2.99	11.86	10.00	8.87	8.00	1.08	4.44	4.00	14838
1	3.42	4.99	4.93	0.76	4.41	0.68	5.85	5.00	5.17	4.00	1.10	3.94	4.00	14837
5	2.70	4.08	4.11	2.28	1.67	0.35	4.30	4.50	3.95	4.00	0.24	2.88	3.00	14777
4	0.50	1.62	1.65	6.41	2.06	1.24	9.71	8.50	8.47	8.00	8.91	8.91	10.00	14946
3	0.52	1.59	1.65	5.55	1.94	0.95	8.44	8.50	7.49	8.00	4.72	4.72	5.00	14544
8	0.50	1.74	1.65	5.96	1.85	0.90	8.71	8.50	7.81	8.00	2.00	2.00	2.00	14867
e	0.56	1.54	1.65	6.25	1.49	1.05	8.79	8.50	7.74	8.00	2.54	2.54	3.00	14771
	..	1.58	1.65	6.41	2.20	0.31	8.92	8.50	8.61	8.00	2.83	2.83	3.00	15358
9	0.71	1.87	1.65	5.86	1.45	1.38	8.69	8.50	7.31	8.00	1.00	1.00	1.00	14578
6	0.47	3.06	3.30	5.72	2.71	1.29	9.72	8.50	8.43	8.00	5.78	5.78	7.00	14927
4	0.71	3.04	3.30	5.53	2.46	1.18	9.17	8.50	7.99	8.00	3.64	3.64	4.00	14868
5	2.46	3.87	4.11	2.33	2.05	0.40	4.78	4.50	4.38	4.00	0.30	5.20	5.00	14878
8	0.99	1.79	1.65	3.45	4.98	2.03	10.46	9.00	8.43	8.00	3.08	3.08	3.00	14637
1	3.38	4.53	4.11	0.91	4.40	0.23	5.54	5.00	5.31	4.00	1.00	4.15	5.00	14768
2	0.82	2.07	1.65	4.67	3.96	1.16	9.79	9.00	8.63	8.00	1.88	1.88	2.00	14634
)	1.24	3.71	3.29	4.47	3.92	1.56	9.95	9.00	8.39	8.00	3.17	3.17	4.00	14720
5	1.77	3.87	3.29	6.75	3.09	1.02	10.86	9.00	9.84	8.00	4.52	4.52	4.00	15129
4	0.84	2.48	2.47	5.08	3.72	1.11	9.91	9.00	8.80	8.00	3.81	3.81	4.00	14580
4	1.13	2.65	2.47	5.22	2.90	1.78	9.90	9:00	8.12	8.00	4.05	4.05	4.00	14636
)	1.76	4.04	4.11	6.34	3.01	2.00	11.35	9.00	9.35	8.00	4.19	4.19	4.00	14925
.25		1.43	1.23	0.05	1.00	0.13	1.18	1.00	1.05	.....	2.27	3.12	3.00	14917
)	1.83	3.61	2.47	6.30	2.99	1.56	10.85	11.00	9.29	10.00	4.68	4.68	3.00	14922
7	1.44	2.52	2.46	4.94	3.63	2.53	11.10	11.00	8.57	8.00	3.72	3.72	3.00	14835
3	1.63	3.11	3.30	7.47	2.71	1.64	11.82	11.00	10.18	8.00	4.44	4.44	5.00	14836

TABLE VIII. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampl
	Sampled by Station:	
	Springfield Rendering Co., Springfield, Mass.	
14642	Animal Brand	Thompsonville
14919	Grain and Grass	Suffield
14920	Tobacco Special	Hazardville
	Virginia-Carolina Chemical Co., New York City.	
14724	Challenge Brand	Hartford
14725	Champion Brand	Hartford
14966	Cherokee Brand	Glastonbury
14968	Indian Chief Brand	Glastonbury
14967	Owl Brand	Glastonbury
15084	Plant Food for Vegetables, Lawns and Flowers	Waterbury
	Wilcox Fertilizer Co., Mystic, Conn.	
14577	Corn Special	Branford
15123	*Fish and Potash	Branford
14721	Grass Fertilizer	Mystic
14717	High Grade Fish and Potash	Burnside
14576	Potato Fertilizer	Branford
14723	*Potato and Vegetable Phosphate	Jewett City
15012	Tobacco Special	Ellington
	S. D. Woodruff and Sons, Orange, Conn.	
14498	Home Mixture	Orange
	Worcester Rendering Co., Auburn, Mass.	
14928	Prosperity Brand Royal Worcester Corn and Grain Fertz.	Putnam
14926	†Prosperity Brand Royal Worcester Potato and Vegetable Fertz	Willimantic
14960	Prosperity Brand Royal Worcester Special Grain Fertz.	Greenville
	The World's Fertilizer Process Co., Sharpsburg, Pa.	
14769	Shur-Gro	Hartford
	Sampled by Purchaser:	
15330	American Ag'l Chem'l Co. 5-8-7	Winsted
14783	Apothecaries Hall Co.'s Liberty Brand 4-8-4	Branford
15143	Atlantic Packing Co.'s Potato Phosphate 3-8-4	Westville
15089	‡Berkshire Tobacco Starter	Suffield
14752	Frisbie's 4-8-4	Milford
14804	Frisbie's 5-5-4	Somers
14682	Frisbie's Bone Base 4-8-4	Woodmont
15087	Mapes' Corn Manure	Hartford

*See note, page 59. †See note, page 56. ‡See note, p

WITH POTASH—(*Continued*).

itrogen.				Phosphoric Acid.							Potash.			
		Total.					Total.		So-called "Available."					
water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As muriate.	Total.	Guaranteed.	Station No.
24	0.68	2.76	2.46	4.92	3.31	0.88	9.11	9.00	8.23	8.00	4.38	4.38	4.00	**14642**
58	0.53	1.81	1.64	5.26	3.19	0.40	8.85	9.00	8.45	8.00	2.39	2.39	2.00	**14919**
08	1.75	4.32	4.10	1.50	3.40	1.88	6.78	6.00	4.90	5.00	0.80	4.03	4.00	**14920**
26	0.48	0.97	0.82	7.07	2.26	1.28	10.61	...	9.33	9.00	3.04	3.04	3.00	**14724**
57	1.30	3.20	3.29	5.47	3.02	1.18	9.67	...	8.49	8.00	4.19	4.19	4.00	**14725**
35	3.23	4.70	4.11	1.84	1.95	0.20	3.99	...	3.79	4.00	0.30	3.33	3.00	**14966**
35	2.73	4.36	4.11	2.29	1.70	0.32	4.31	...	3.99	4.00	0.51	7.18	5.00	**14968**
37	0.27	1.78	1.65	5.97	1.67	0.65	8.29	...	7.64	8.00	2.57	2.57	3.00	**14967**
13	1.40	5.04	4.94	5.26	3.22	1.92	10.40	...	8.48	8.00	0.90	1.77	2.00	**15084**
ne	2.80	3.78	3.29	3.42	5.24	3.89	12.55	9.00	8.66	8.00	0.45	2.67	2.00	**14577**
34	1.76	2.56	2.46	6.36	2.60	0.51	9.47	9.00	8.96	8.00	1.33	1.33	1.00	**15123**
25	1.73	4.01	4.12	5.64	2.38	0.40	8.42	9.00	8.02	8.00	2.23	2.23	2.00	**14721**
30	1.37	2.82	2.46	6.27	2.42	0.24	8.93	9.00	8.69	8.00	3.26	3.26	3.00	**14717**
23	1.46	2.19	1.65	6.58	2.20	2.41	11.19	9.00	8.78	8.00	2.44	2.44	2.00	**14576**
20	1.48	3.29	3.29	5.80	2.37	1.68	9.85	9.00	8.17	8.00	3.90	3.90	4.00	**14723**
35	2.84	4.17	4.12	0.50	2.73	2.25	5.48	5.00	3.23	3.00	0.41	4.18	4.00	**15012**
.49		3.14	3.29	2.79	3.63	1.50	7.92	8.00	6.42	...	1.34	4.24	3.00	**14498**
1	0.44	1.78	1.64	6.08	3.04	0.73	9.85	9.00	9.12	8.00	2.26	2.26	2.00	**14928**
06	1.14	3.12	3.29	4.16	3.88	1.00	9.04	9.00	8.04	8.00	4.08	4.08	4.00	**14926**
51	0.38	0.95	0.82	7.12	3.25	1.14	11.51	11.00	10.37	10.00	1.04	1.04	1.00	**14960**
	..	0.13	..	0.62	6.81	0.54	7.97	5.50	7.43	5.00	0.40	2.00	2.00	**14769**
50	0.59	3.44	4.13	5.57	3.77	1.01	10.35	...	9.34	8.00	5.54	6.12	7.00	**15330**
72	1.51	3.58	3.29	5.55	2.62	0.82	8.99	...	8.17	8.00	3.86	3.86	4.00	**14783**
	..	2.44	2.47	..	..	..	8.16	9.00	...	...	...	4.06	4.00	**15143**
.96		4.98	5.00	0.54	2.99	0.09	3.62	5.00	3.53	4.00	1.71	7.56	8.00	**15089**
	..	3.09	3.28	..	..	1.11	9.17	9.00	8.06	8.00	..	3.68	4.00	**14752**
	..	...	...	..	..	..	...	...	...	...	0.70	4.00	4.00	**14804**
	..	3.40	3.29	4.19	3.51	1.15	8.85	...	7.70	8.00	..	4.26	4.00	**14682**
	..	2.66	2.47	..	..	..	10.29	10.00	...	...	..	3.10	3.00	**15087**

TABLE VIII. NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampli
	Sampled by Purchaser:	
15068	Mapes' General Tobacco Manure	Hartford
15069	Mapes' Potato Manure 1916	Hartford
15067	Mapes' Tobacco Starter, Improved	Hartford
15022	Olds & Whipple's Complete Tobacco Fertilizer	Tariffville
14506	Rogers & Hubbard's Oats and Top Dressing	Winsted
15036	Rogers & Hubbard's Soluble Tobacco Manure	Glastonbury
15070	Sanderson's Bone Fish and Potash	Branford
	Sampled by Manufacturer:	
14307	Frisbie's 2-8-2	New Haven
14306	Frisbie's 3-8-4	New Haven
14305	Frisbie's Complete Fertilizer 3-8-4	New Haven
14379	Frisbie's 3-8-4	New Haven
14380	Frisbie's 4-8-4	New Haven

		Deficier
14748	Armour's Wheat and Clover Fertilizer	$5.4(
14690	Atlantic Packing Co.'s Grain Fertilizer	3.5
15050	Atlantic Packing Co.'s Tobacco Grower	3.1
15030	Columbia Guano Co.'s Freedom Guano	2.87
15027	Essex Fertilizer Co.'s Tobacco 5-5-4	1.3(
14874	Essex Fertilizer Co.'s 2-8-2	1.1
15028	Essex Fertilizer Co.'s 4-8-4	2.3
14582	L. T. Frisbie Co.'s 2-8-2	4.0
14911	L. T. Frsibie Co.'s Tobacco Special	3.61
14658	L. T. Frisbie Co.'s Tobacco 5-5-5	2.4(
15043	Hubbard Fertilizer Co.'s Noxall Guano	1.61
14865	Lister's Agl. Chem'l Works, Complete Tobacco Manure	1.52
15049	Lowell Fertilizer Co.'s Lawn and Garden Dressing	1.54
14817	Lowell Fertilizer Co.'s 5-8-4	4.9
15013	Mapes F. & G. P. Co.'s Grain Brand	2.3
14648	New England Fertilizer Co.'s Corn Phosphate 2-8-2	1.81
14964	Parmenter & Polsey's 2-8-2	1.6
14856	Piedmont-Mt. Airy Guano Co.'s Brown's H. G. Potato and General Crop	4.28
14963	Piedmont-Mt. Airy Guano Co.'s Shay's Corn Fertilizer	4.0(
14962	Piedmont-Mt. Airy Guano Co.'s Shay's Potato Fertilizer	5.88
14544	F. S. Royster Guano Co.'s Bully Guano	2.52
14927	F. S. Royster Guano Co.'s Quality Trucker	5.44
14868	F. S. Royster Guano Co.'s Trucker's Delight	3.75
14926	Worcester Rendering Co.'s Prosperity Brand Potato and Vegetable Fertilizer	1.36

WITH POTASH—(*Concluded*).

(Ni)trogen.				Phosphoric Acid.							Potash.			
		Total.					Total.		So-called "Available."					
(Organic,) water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As muriate.	Total.	Guaranteed.	Station No.
	..	3.95	4.12	..	..	..	4.89	4.00	...	...	..	5.01	5.00	**15068**
	..	3.81	3.71	..	..	..	10.07	8.00	...	...	...	1.40	1.00	**15069**
	..	4.19	4.12	..	..	..	9.07	8.00	...	...	...	1.51	1.00	**15067**
	..	4.53	4.11	..	..	..	5.16	4.00	...	...	...	4.18	4.00	**15022**
1.58		8.32	8.22	0.41	4.75	2.60	7.85	8.00	5.16	3.00	4.30	4.30	4.00	**14506**
.	..	4.64	4.93	..	..	..	10.76	10.00	...	...	1.10	4.80	4.00	**15036**
[illegible].22		2.76	1.65	5.18	3.33	1.84	10.35	...	8.51	8.00	4.18	4.18	3.00	**15070**
	..	2.01	..	..	..	..	10.73	...	...	...	..	2.01	..	**14307**
	..	2.47	..	..	..	..	8.79	...	...	...	...	4.32	..	**14306**
	..	2.52	..	..	..	...	9.26	...	...	...	...	3.90	..	**14305**
	..	3.03	..	..	..	1.02	10.17	...	9.15	...	..	3.84	..	**14379**
	..	3.72	..	..	..	1.10	9.43	...	8.33	...	..	3.78	..	**14380**

QUALITY OF THE NITROGEN.

'he solubility of the nitrogen was tested in every sample exam-
l, and in none was evidence found of the use of inferior am-
niates.

ANALYSES REQUIRING SPECIAL NOTICE.

15110 Chittenden's Complete Tobacco and Onion Grower was tagged Potato Special with Four Per Cent. Potash through an error at the factory which was corrected.

15030 Columbia Guano Co.'s Freedom Guano was deficient in all three guaranteed ingredients. It is suggested that two brands were mixed through a mistake in tagging. All the packages sampled by our agent bore the above brand.

14771 Royster's Fish, Flesh and Fowl Guano was deficient in all three guaranteed ingredients. The manufacturer felt that this sample did not fairly represent the composition of this brand. A second sample was therefore analyzed, **15358** which while defficient in potash more nearly met the guaranty.

15089 A special mixture with 8 per cent. of potash guaranteed. This sample was sent by J. E. Phelps, Suffield. As it failed to meet its guaranty, at the request of the manufacturer, the Station agent drew a sample in October

from 12 bags remaining in T. F. Devine's stock. He found the bags wet on the outside, and the resulting analysis, No. **15444,** showing nitrogen 4.44, phosphoric acid 3.16, and potash 7.61 per cent., could not have represented the quality of the goods as sold.

Borax in Commercial Fertilizers.

Injury to farm crops caused by borax in the fertilizers used was first brought to serious attention by the experience of corn growers in Indiana in 1917. Later the same trouble was reported from the potato districts of Maine and cotton districts in the South. Evidence indicated that injury followed the use of fertilizers containing potash with considerable amounts of borax. The damage was greatest where the largest amount of potash had been applied; and also in fields where the fertilizer was drilled in with the seed and conditions resulted which left the seed in contact with the fertilizer too long.

The explanation of how borax acts to cause the effects noted is largely speculative at the present time. It has been suggested, and it appears quite plausible, that borax unites with some constituent of the nutrient juices in plants in such a way as to prevent or hinder the ready diffusion of food material to the various parts of the plant system. Interference with enzyme action and other causes have been suggested.

There are no data upon which to base an accurate statement as to the limits of tolerance to borax exhibited by plants. If such limits were definitely established they would be modified by varying field conditions. It was with a view to insuring an ample margin of safety that the Secretary of Agriculture issued an order[1] concerning borax in mixed fertilizers which limited the amount of boron, expressed as anhydrous borax, in any fertilizer or fertilizer ingredient sold for application to the soil to one-tenth of one per cent. unless the goods so sold were plainly marked to show the amount present.

During the past season all mixed fertilizers and potash and nitrate salts inspected by this Station have been examined for borax. Preliminary qualitative tests were made and these were followed by quantitative determinations in suspicious cases.

The qualitative test employed was substantially that proposed by Bartlett[2] but modified in this laboratory[3] in that the fertilizer suspension was more strongly acidified and the turmeric strips were dried out at room temperature to avoid the charring due to hydrochloric acid at the temperature of boiling water.

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[1] S. R. A., Bureau of Soils, Dec. 23, 1919.
[2] Maine Experiment Station.
[3] By Mr. C. E. Shepard.

Our procedure is as follows:

Digest about 5 grams of fertilizer with 10cc of water for 10 minutes on a steam bath. Acidify with 2cc of concentrated hydrochloric acid, stir thoroughly and allow to settle. Moisten a strip of turmeric paper with the supernatant liquid and allow to dry at room temperature or in a desiccator if the atmosphere is humid. Color due to boric acid is generally indicated in about 10 minutes and results may be noted within an hour.

For the quantitative determination of borax the methods of Ross and Deemer[1] and of J. M. Bartlett[2] have been used with about equally satisfactory results.

None of the brands examined at this Station during the past season contained borax in an amount likely to be injurious to crops unless applied close to the seed in large amounts, say 2,000 pounds per acre.

The brands in which more than one-tenth per cent. of borax was found were the following:

		Per cent. Borax.
15043	Hubbard's Noxall Guano	0.22
14742	Mapes' General Truck Manure	0.17
14653	Mapes' Potato Manure 1916 Brand	0.12
14883	R. & H.'s Hubbard's Bone Base Oats and Top Dressing	0.19
15123	Wilcox Fertilizer Co.'s Fish and Potash	0.14
14723	Wilcox Fertilizer Co.'s Potato and Vegetable Phosphate	0.18

During the winter and spring the Stations in the Northeastern States co-operated in carrying out elaborate potato experiments with corn, beans and potatoes, to study the action of borax on the growth of these crops. This experiment was conducted at the Vermont Station through the co-operation of Dr. J. L. Hills, Director, and was in direct charge of Mr. J. R. Neller.

A full account of this work is not yet ready for publication. Some of the more important results are briefly as follows:

Borax-containing fertilizers applied below the seed are much more liable to injure them than applied above the seed or broadcast.

One or two pounds of borax in the fertilizer were not harmful to either crop, whether broadcast or applied in the drill, but it was not conclusively shown that the five-pound application in the drill was harmless. Ten and twenty pounds of borax per acre were certainly injurious or ruinous.

Lime and gypsum, as well as manure, seemed partially to neutralize the poisonous action.

HOME-MIXED NITROGENOUS SUPERPHOSPHATES.

14782. Mixed by the Apothecaries Hall Co., Waterbury, to order of the A. E. Plant Sons Co., Branford. 200 lbs. nitrate of soda, 900 lbs. tankage, 900 lbs. phosphate.

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[1] Respectively, Bureau of Soils and Bureau of Plant Industry Washington, D. C.

[2] Maine Experiment Station.

15142. Mixed by the Apothecaries Hall Co., Waterbury, to order of Paul Cavanna, South Glastonbury. 2,800 lbs. nitrate of soda, 2,800 lbs. bone tankage (3-50), 4,200 lbs. acid phosphate, 4,200 lbs. cottonseed meal.

15092, 15094, 15095, 15097, 15099, 15101, 15102 and 15103. Mixed by A. L. Koster, Suffield, to order of the American Sumatra Tobacco Co., Hartford. Each analysis represents a sample taken from a car lot.

14713. Made by V. E. Lucchini, Meriden. Acid phosphate, nitrate of soda and tankage.

14714. Made by V. E. Lucchini, Meriden. Acid phosphate, nitrate of soda and tankage.

14427. Mixed by Olds & Whipple, Hartford, to order of American Sumatra Tobacco Co., Hartford.

15096. Mixed by Olds & Whipple, Hartford, to order of American Sumatra Tobacco Co., Hartford.

15098. Mixed by Olds & Whipple, Hartford, to order of American Sumatra Tobacco Co., Hartford.

15100. Mixed by Olds & Whipple, Hartford, to order of American Sumatra Tobacco Co., Hartford.

TABLE IX. ANALYSES OF HOME-MIXED NITROGENOUS SUPERPHOSPHATE

Station No.	Nitrogen					Phosphoric Acid.					Pota
	In nitrates.	In ammonia.	Organic water-soluble.	Organic water-insoluble.	Total found.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total found.	So-called "Available" found.	As muriate.
14782	1.83	0.14	0.74	1.30	4.01	6.36	3.79	4.23	14.38	10.15	......
15142	2.39	None	2.31		4.70	2.28	4.81	0.59	7.68	7.09	0.62
15092	None	1.08	4.26		5.34	0.92	4.83	0.92	6.67	5.75	1.73
15094	0.81	1.01	3.62		5.44	1.01	5.44	1.43	7.88	6.45	1.62
15095	0.91	0.80	3.17		4.88	1.10	5.89	1.73	8.72	6.99	2.13
15097	0.70	1.00	3.33		5.03	0.81	5.26	1.82	7.89	6.07	1.42
15099	0.97	0.77	3.62		5.36	0.82	5.51	0.96	7.29	6.33	1.62
15101	0.80	0.72	3.77		5.29	0.88	5.17	0.83	6.88	6.05	1.20
15102	0.69	1.00	3.15		4.84	0.86	5.12	1.89	7.87	5.98	1.46
15103	0.90	0.75	3.08		4.73	0.72	4.98	1.45	7.15	5.70	1.54
14713	.....	.....	.....	.....	5.33	4.63	4.07	4.63	13.33	8.70	......
14714	.....	.....	.....	.....	4.19	4.68	4.49	5.00	14.17	9.17	......
14427	.....	.....	.....	.....	5.99	0.50	5.61	0.17	6.28	6.11	......
15096	0.77	0.07	5.56		6.40	1.30	4.37	0.19	5.86	5.67	0.52
15098	0.57	0.07	5.34		5.98	1.17	4.51	0.23	5.91	5.68	0.70
15100	0.72	0.04	5.34		6.10	1.29	4.52	0.20	6.01	5.81	0.53

VI. MISCELLANEOUS FERTILIZERS AND WASTE PRODUCTS.

TOBACCO STEMS AND DUST.

Four samples were analyzed as follows:

14382. Tobacco Stems. Sent by the Everett B. Clark Seed Co., Milford.

14309. Stem Butts. Sent by Morgan & Dickinson, Windsor.

14310. Tobacco Dust. Sent by J. N. Root, W. Suffield.

14429. Tobacco Stems. Sent by Gordon Scholes, Warehouse Point.

ANALYSES OF TOBACCO STEMS AND DUST.

Station No	14382	14309	14310	14429
Nitrogen	2.28	1.59[1]	2.20[2]	3.13
Phosphoric acid	0.32	0.40	0.47	....
Potash (total)	4.86	4.50	2.14	7.86

[1] 0.47 nitrogen in nitrates.
[2] 0.66 nitrogen in nitrates.

LIME-FERTILE AND NITRO-FERTILE.

14485. Lime-Fertile, made by Fertile Chemical Co., Cleveland, Ohio. Stock of A. R. Brewer, Hartford.

14538. Nitro-Fertile, made by Fertile Chemical Co., Cleveland, Ohio. Stock of Church & Morse, Meriden.

ANALYSES OF LIME-FERTILE AND NITRO-FERTILE.

Station No	14485		14538	
	Found	Guaranteed	Found	Guaranteed
Nitrogen as nitrates	....	....	1.12	....
Nitrogen (total)	....	....	2.08	2.00
Phosphoric acid	3.17	3.00	3.48	3.00
Potash calculated as sulphate	....	....	1.71	....
Potash calculated as muriate	....	....	2.60	....
Potash (total)	....	....	4.31	3.00
Lime	28.65	....	....	....

Nitro-fertile is a solution for use on potted plants, costing 35 cents per half-pint, and Lime-fertile is also sold in small packages, five pounds for 25 cents. The plant food in a package, at the ordinary rates for fertilizers, is worth at most about 2½ cents.

SHEEP MANURE.

Nine samples were analyzed as follows:

14519. Pulverized Sheep Manure. Sold by American Agricultural Chemical Co., New York City. Stock of Southington Lumber Co., Southington.

14521. Liberty Brand Sheep Manure. Sold by Apothecaries Hall Co., Waterbury. Sampled at factory.

15159. Sheep Manure. Berkshire Fertz. Co., Bridgeport. Sampled at factory.

15108. Rams Head Brand. Sold by Joseph Breck & Sons Corp., Boston. Stock of G. M. Williams Co., New London.

14613. Magic Brand Pulverized Sheep Manure. Sold by Chicago Feed & Fertz. Co., Chicago, Ill. Stock of Blish Hardware Co., South Manchester.

14770. "Sheep's Head" Pulverized Sheep Manure. Sold by Natural Guano Co., Aurora, Ill. Stock of Cadwell & Jones, Hartford.

15041. Groz-It Brand Sheep Manure. Sold by Pacific Manure and Fertilizer Co., San Francisco, Calif. Stock of F. M. Cole, Putnam.

14523. Wizard Brand Sheep Manure. Sold by Pulverized Manure Co., Chicago, Ill. Stock of S. P. Strople, New Britain.

14579. Sheep Manure. Sold by S. D. Woodruff & Sons, Orange. Stock of Rackliffe Bros Co., New Britain.

TABLE X. ANALYSES OF SHEEP MANURE.

Station No.	**14519**	**14521**	**15159**	**15108**	**14613**	**14770**	**15041**	**14523**
Per cent. of								
Nitrogen as nitrates	None	0.14	0.12	.....	0.14	None	0.17	None
" " ammonia	0.45	0.09	0.18	0.50	0.09	0.40	0.05	0.10
" organic	2.25	1.32	1.91	2.09	1.47	2.10	1.28	1.65
" total found	2.70	1.55	2.21	2.59	1.70	2.50	1.50	1.75
" " guaranteed	2.06	1.50	1.70	1.84	1.85	2.25	1.84	1.80
Phosphoric acid, water-soluble	0.98	0.26	0.13	0.94	0.06	0.95	0.11	0.34
Phosphoric acid, citrate-soluble	0.55	0.45	1.70	0.77	0.67	0.84	0.73	0.77
Phosphoric acid, citrate-insoluble	0.12	0.17	0.10	0.09	0.19	0.13	0.03	0.14
Phosphoric acid, total found	1.65	0.88	1.93	1.80	0.92	1.92	0.87	1.25
Phosphoric acid, total guarteed	1.25	1.00	1.00	1.25	1.43	1.25	1.25	1.00
Water-soluble potash found	2.37	3.36	2.14	2.43	3.57	2.60	3.39	2.17
Water-soluble potash guaranteed	1.00	2.00	1.00	3.00	1.25	1.50	3.00	1.00
Chlorine	0.89	1.58	.....	0.84	2.30	0.53	1.73	0.44
Cost per ton	$33.00	35.00	40.00	65.00	50.00	48.00	48.00	57.00

14613. Magic Brand, and **15041** Groz-It Brand, fail to meet their guaranties of nitrogen and phosphoric acid.

Sheep manure, being fine and dry, is well adapted to greenhouse work and for a dressing for lawns.

A comparison with New York horse manure is as follows:

Pounds of the ingredients named in one ton.

	Sheep Manure	Horse Manure
Organic matter	1426	540
Nitrogen	40	13
Phosphoric acid	27	9
Potash	56	12

Three and one-half tons of horse manure contain on the average as much plant food as does one ton of sheep manure.

The prices quoted by dealers range from $33 to $65 per ton, the higher prices probably are quoted for sales in small quantities.

It is doubtful if sheep manure will promote bacterial activity in the soil as effectively as fresh manures, but if the cost of fresh manure rises much further the dried manures may come into use on the farm where it is felt that manure must be used.

LIME AND LIME-KILN ASHES.

14235. Agricultural Lime. Sold by Grangers' Agricultural Lime Co., West Stockbridge, Mass. Sent by E. H. Ocain, Falls Village.

14629. Lime. Sent by Raymond Bros., South Norwalk.

14803. Ground Limestone. Sold by the Stearns Lime Co., Danbury. Sent by C. R. Treat, Orange.

15161. Lime-Kiln Ashes. Sent by A. B. Smith, Clintonville.

Analyses of Lime and Lime-Kiln Ashes.

Station No.	**14235**	**14629**	**14803**	**15161**
Water-soluble potash	......	......	......	2.17
Lime	39.74	37.50	38.56	41.34
Insol. in acid	13.58	......	25.68	14.71

14803 was stated by Mr. Treat to have a guaranty of 45 per cent. calcium oxide and 75 per cent. to pass a 100-mesh screen. Only 60 per cent. of the sample passed such a screen.

The manufacturers state that the hard winter and the great demand for lime made it necessary to fill orders as best they could, and some lime of inferior quality like **14803** got shipped out which was quite inferior to the normal product.

In the last ten years ten analyses of lime from this firm show percentages of lime ranging from 43.44 to 47.36 and averaging 45.43 per cent. of lime, equivalent to 81.1 per cent. of calcium carbonate, with 3.23 per cent. of magnesia.

WOOD ASHES.

In a table, page 65, are given analyses of wood ashes.

15106 is from the furnace of the Cheshire Mill.

14646 was sent by R. S. Griswold, who stated that the ashes were bought of A. E. Dickenson & Co., of Essex, with a guaranty that they should be as good as those bought the year before.

This sample contained 32.18 per cent. of insoluble matter and only 1.31 per cent. of water-soluble potash.

Later the sampling agent of the Station drew a sample of these ashes at Mr. Griswold's request, the analysis of which appears as No. **15086**.

Ten car lots of ashes from John Joynt, Lucknow, Can., six of them sold to the American Sumatra Tobacco Co., Nos. **14844** to **14848** and **15093**, and four other car lots, Nos. **14252, 14467, 14985** and **15017,** were of excellent quality.

But three other samples from the same dealer were of very inferior composition, **14513, 14888** and **14984.**

15367 from Geo. Stevens, Peterborough, Can., is not *unleached* hard wood ashes.

At $5.50 per unit, potash in wood ashes costs 27 cents per pound, at $6.00 per unit, potash costs 30 cents per pound. This is about double the cost in potash salts mentioned on page 25. Ashes, however, contain 1.5 to 2.0 per cent. of phosphoric acid and about 30 per cent. of lime in form of carbonate, which add considerably to their value.

14987. Phos-Pho-Germ. Made by the American Nitro-Phospho Corporation, 80 Lafayette St., New York City.

It is claimed to be a mixture of humus, raw phosphate, lime, wood ashes, sulphur and various bacterial foods, and inoculated with many strains of vigorous, beneficial soil bacteria.

The sample drawn by a Station agent from stock of George Yuengling, New Canaan, had a guaranty of 0.82 per cent. nitrogen, 8.00 per cent phosphoric acid, of which 0.25 is available, and 0.15 per cent. of potash.

The analysis is as follows:

Per cent. of	
Nitrogen	0.50%
Available phosphoric acid	1.16
Total phosphoric acid	17.27
Potash	0.22
Cost per ton	$45.00

It fails to meet its guaranty of nitrogen. The plant food in a ton of it is, liberally estimated, worth about $15. Whether the "vigorous, beneficial soil bacteria" in a ton of it are worth $30, the difference between the value of the plant food and the ton price, may well be doubted.

A sample stated to be Cocoon Dust, **15214,** sent by the National Spun Silk Co. of New Bedford, Mass., contained 8.99 per cent. of nitrogen in fairly soluble and available condition, 1.41 per cent. of phosphoric acid and 0.25 per cent. of potash with 83.13 per cent. of organic matter; apparently an excellent nitrogenous fertilizer.

15210. Wool Waste from A. B. Smith, Clintonville. Contained 1.35 per cent. nitrogen, probably in inert form.

TABLE XI. ANALYSES OF WOOD ASHES.

Car No. and Dealer or Purchaser.	Insoluble in acid (sand).	Water-soluble, potash.	Lime.	Phosphoric acid.	Cost per ton.
C. G. R. No. 250022 Frank Bailey, Barre, t. Frank N. Brockett, Suffield	21.78	4.20	25.85	1.47	$25.00
n. Brass & Mfg. Corp., Waterbury	7.96	4.72	43.76	2.70	......
:. Dickenson & Co. R. S. Griswold, Wethsfield,	32.18	1.31	16.37	1.54	......
:. Dickenson & Co. R. S. Griswold, Wethsfield	......	1.84	16.82	1.71	......
No. 201591. John Joynt, Lucknow, Ont. merican Sumatra Tobacco Co., Bloomfield	20.50	6.05	30.24	2.02	(1)
No. 19698. John Joynt, Lucknow, Ont. merican Sumatra Tobacco Co., Bloomfield	10.40	5.63	36.98	2.24	(1)
No. 16567. John Joynt, Lucknow, Ont. merican Sumatra Tobacco Co., Bloomfield	12.90	7.18	34.80	2.26	(1)
No. 6920. John Joynt, Lucknow, Ont. merican Sumatra Tobacco Co., Bloomfield	16.69	6.50	31.74	2.19	(1)
No. 4067. John Joynt, Lucknow, Ont. merican Sumatra Tobacco Co., Bloomfield	15.12	6.63	32.00	2.41	(1)
No. 11609. John Joynt, Lucknow, Ont. hn Wolf, Windsor	10.04	4.79	31.67	1.00	(2)
No. 80633. John Joynt, Lucknow, Ont. N. Lasbury, Broad Brook	12.65	4.96	28.03	1.59	......
Joynt, Lucknow, Ont. A. D. Bridge Sons o., Hazardville	25.41	1.42	18.55	0.58	22.00
No. 243740. John Joynt, Lucknow, Ont. eo. T. Soule, New Milford	27.58	0.52	21.21	1.66	26.00
Joynt, Lucknow, Ont. Geo. T. Soule, ew Milford	21.34	0.85	28.70	1.33	26.00
No. 84738. John Joynt, Lucknow, Ont. . Jones, South Windsor	13.30	5.72	31.64	2.02	(1)
No. 50110. John Joynt, Lucknow, Ont. . Jones, South Windsor	23.35	4.63	26.18	2.26	(1)
No. 10301. John Joynt, Lucknow, Ont. merican Sumatra Tobacco Co., Hartford	13.34	6.56	34.27	2.06	......
. Stevens, Peterborough, Can. F. W. Judson, Waterbury	16.22	0.88	......	3.99	15.00
n Chase Metal Works, Waterbury. Sent A. F. Greene, Woodbury	9.08	5.49	......	1.61	......

[1] unit of water-soluble potash. [2] $6.00 per unit of water-soluble potash.

14753. Stated to be "a factory waste." Sent by F. A. Jordan, oodstock. Contained 7.63 per cent. of nitrogen, .40 per cent. which was in form of ammonia and all of which appeared to in available form.

14939. Stated to be Chili Saltpeter. Guaranteed 15.50 per t. nitrogen and 17.20 per cent. potash.

It contained 11.38 per cent. of nitrogen, 17.05 per cent. of potash, and 0.38 per cent. of borax. It is apparently a waste product from the refining of nitrate of soda.

14940. Stated to be a residue from a Welsbach burner factory and sent by Prof. Browning of Yale University. It contained:

Water-soluble phosphoric acid	0.50%
Citrate-soluble phosphoric acid	16.90
Citrate-insoluble phosphoric acid	10.78
Total phosphoric acid	28.18

14916. Stated to be a solution in which refuse rubber is heated under steam pressure.

It had a sp. gr. of 1.017, contained 2.86 per cent. of solid matter, 1.21 per cent. of potash and a little combined sulphur. Of no value as an insecticide or fungicide.

13575. Thought to be wood ashes, contained 33.63 per cent. of insoluble matter, 0.77 per cent. of phosphoric acid and 0.45 of potash.

14937. A sample of fresh menhaden fish. They contain an average of water 77.0 per cent., oil 4.00 per cent., nitrogen 1.5, phosphoric acid 1.5, and potash 0.3 per cent.

14399. A mixture of several brands of fertilizer. Sent by F. J. Harrison, Waterbury. Contained 0.88 per cent. nitrogen, 14.90 of phosphoric acid and 0.07 of potash.

Five other samples were examined qualitatively, but have no general interest of importance.

DIRECTIONS FOR PREPARING INSECTICIDES AND FUNGICIDES.

FORMULAS FOR INSECTICIDES.

LEAD ARSENATE.

) or 1½ lbs. (Dry) Lead Arsenate and 50 gals. Water.
foliage to kill all chewing insects. May be used with
h lime-sulphur mixture.

PARIS GREEN.

1 lb. Paris Green. 3 lbs. Lime.
100 gals. Water.

oliage to kill potato beetle, elm leaf beetle, and all chewing
nonly used with Bordeaux mixture on potatoes, largely
ead arsenate.

CALCIUM ARSENATE.

y Calcium Arsenate. 1½ lbs. Dry Air-Slaked Lime.
50 gals. Water.

ist or spray on potatoes. May be used in Bordeaux mix-
on fruit trees.

POISONED BRAN MASH.

heat Bran. 4 oz. White Arsenic or Paris Green.
heap Molasses. 1 Lemon. 7 pints Water.
a dry mash and scatter around in field to kill cut-worms,
d grasshoppers.

HELLEBORE.

plants, or mix with water, 1 oz. in 2 gals. and spray. For
nd other saw-fly larvae.

LIQUID LIME-SULPHUR.

Winter Spray.

part Lime and Sulphur. 9 parts Water.

Summer Spray

NICOTINE SOLUTION.

½-¾ pint in 50 gals. Water. Dissolve a 1 inch cube of Laundry
and add for a Spreader.

Several solutions are now sold containing 40% or more of nic
Excellent for killing aphids and other sucking insects.

KEROSENE EMULSION.

2 gals. Kerosene. 1 lb. Common Soap. 1 gal. Water.

Dissolve the soap in hot water, add the kerosene, and churn tog
with pump until a white creamy mass is formed which thickens on co
Dilute *nine* times before using for most aphids, but may be used str
or weaker.

MISCIBLE OILS.

Several miscible oils are on the market, such as "Scalecide" and "J
Compound," for killing San José scale, especially on old apple
mix 1 part in 15 parts water.

COMMON LAUNDRY SOAP.

Spray 1 lb. dissolved in 8 gals. water upon foliage to kill red sp
aphids, and other sucking insects.

CARBON DISULPHIDE.

To kill insects infesting stored grain, in tight bins, use 1 lb. for
100 cubic feet of space. Expose for about 36 hours.

PARADICHLOROBENZENE.

A granular solid chemical which gives off fumes fatal to insec
Has recently been used successfully to control the peach borer.

NAPHTHALENE.

Used in the form of moth-balls and "flakes" to keep clothes
out of clothing. "Flakes" scattered around the borders of floor
shelves will drive away ants.

FORMALIN FLY POISON.

1 tablespoonful Commercial Formalin. ½ cup Sweet Milk.

ANT POISON.

Arsenate Soda 125 grains. Sugar 1 pound. Honey 1 tablespoonful. Water 1 quart.

Add arsenate soda and sugar to water. Boil until both are dissolved, then add honey. When cool, place in shallow dishes with a crust of bread or bits of sponge.

HYDROCYANIC ACID GAS.

1 oz. Sodium Cyanide. 2 oz. Sulphuric Acid. 4 oz. Water. For each 100 cu. ft. space.

For fumigating dormant nursery stock or buildings, place the acid and water in an earthen jar in the house, drop in the cyanide and close the house at once for half an hour. Ventilate for ten minutes before entering. In greenhouse use 1 oz. of cyanide for each 1000 cu. ft. of space; avoid sunlight; excessive moisture; driving winds. Fumigate, between 52° and 70°F.

FORMULAS FOR COMMON FUNGICIDES.

LIQUID LIME-SULPHUR.

Winter Spray.

1 part Lime and Sulphur. 9 parts Water.

Summer Spray.

1¼ to 1½ parts Lime and Sulphur. 45 to 50 parts Water.

Use winter spray for San José scale and peach leaf curl; summer spray for fungi, to which, as needed, add lead arsenate to kill chewing insects.

DRY LIME-SULPHUR.

There are now on the market several forms of lime-sulphur or similar fungicides, such as B. T. S., that because of convenience in shipping and handling are replacing somewhat the more bulky liquid fungicides. Where experience has shown that spray injury does not result from their use, they may well be substituted for the latter. Use according to directions given by the manufacturers.

SELF-BOILED LIME-SULPHUR.

8 lbs. Fresh Whitewash Lime.

8 lbs. Fine Sulphur. 45 to 50 gals. Water.

A very excellent substitute for this fungicide is the commercial article called "Atomic Sulphur," especially on peaches where it should be used without lead arsenate at the rate of 8 lbs. to 50 gallons water.

SULPHUR DUST.

Dusting with special grades of very fine sulphur, about 90 parts thoroughly mixed with 10 parts lead arsenate for apples and 80 parts sulphur and 20 parts air-slaked lime for peaches, or with special material prepared by manufacturers, has attained some prominence as a combined fungicidal and insecticidal treatment for fruit trees. Experience so far in this state seems to show that such treatment is much more effective in controlling insects than fungous troubles of the apple. Good results in controlling peach scab and fair results for brown rot are claimed by some authorities. Dusting is much quicker and so cheaper as regards labor, but the cost of material used is considerably greater.

BORDEAUX MIXTURE.

4 lbs. Copper Sulphate.

4 lbs. Fresh Lime. 40 to 50 gals. Water.

Dissolve the copper sulphate in hot water or from a coarse bag suspended in cold water; slake the lime separately and strain. Dilute the latter to about 20 gals., into which pour the copper sulphate, diluted to about 20 gals., stirring the mixture; dilute further to form the forty-five or fifty gallons; or dilute each to 25 gals., and pour together into barrel.

Stock solutions of the copper sulphate and lime, rate 1 lb. to 1 gal. water, can be made separately and used as needed. In this case four gallons of the stock lime is strained into the spray barrel while half filling it with water and then the four gallons of copper sulphate solution are gradually poured in as the barrel is filled to 50 gallons.

FORMALIN.

A. 1 pt. (1 lb.) formalin in 50 gals. water, for sprinkling grain to kill smut. See Smut under Oats.

B. 1 pt. undiluted formalin is *sprayed* directly on 50 bushels of grain as it is shoveled over and then heaped in a pile and covered for four hours.

C. 1 pt. formalin in 30 gals. water; soak uncut tubers 1 hour to prevent potato scab.

D. [illegible]

CORROSIVE SUBLIMATE.

4 oz. Corrosive Sublimate. 30 gallons Water.

Dissolve the *corrosive sublimate* at first in a small amount of *hot* water and then dilute. Soak uncut seed potatoes in this for ½ to 1 hour. After each treatment renew strength by adding 1 oz. of corrosive sublimate and water as needed to retain the 30 gallons. Use in wooden containers and mark *Poison*. Good for both scab and black scurf.

FORMULAS FOR LESS-USED FUNGICIDES.

OTHER BORDEAUX MIXTURES.

Dilute Bordeaux Mixture. Use 1 lb. *copper* sulphate, 4 of lime, and make as above directed. For second and third sprayings of apples to lessen russeting of the fruit.

Soda Bordeaux Mixture. 4 lbs. copper sulphate, 1⅛ to 1½ lbs. soda lye, 50 gals. water. Use only enough lye to make the solution alkaline to test paper. Used sometimes for late spraying of grapes, etc., where spray sediment is objectionable. Care needed in making to avoid spray injury.

Resin Bordeaux Mixture. Melt 5 lbs. resin with 1 pt. fish oil, cool slightly, add 1 lb. soda lye, sitrring. Add 5 gals. water and boil till the mixture will dissolve in cold water. Mix 2 gals. with 48 of Bordeaux mixture. Used sometimes on such glaucous plants as asparagus, cabbage, onions, etc., to make a more adhesive spray.

POTASSIUM SULPHIDE.

3 ozs. Potassium Sulphide. 10 gals. Water.

Used chiefly in greenhouses, or for powdery mildews.

AMM. SOL. COP. CARBONATE.

5 ozs. Copper Carbonate. 3 pts. Ammonia. 45-50 gals. Water.

Use *just enough* ammonia (if strong, dilute with several volumes of water) to dissolve the copper carbonate; then dilute to final volume This fungicide is not as good as Bordeaux, but is used to avoid sediment on the foliage or fruit.

COPPER SULPHATE.

2 to 3 lbs. Copper Sulphate. 45-50 gals. Water.

Used chiefly as a winter spray. 1 lb. to 250 gals. water is sometime though rarely used on foilage.

COPPER LIME-SULPHUR.

2 lbs. Copper Sulphate. 1½ gals. liquid Lime-Sulphur. 45-50 gals. Water

Dissolve copper sulphate in part of the water, and then add witl the lime-sulphur to the remainder. Apparently a good fungicide bu likely to russet apples as does strong Bordeaux.

FORMALIN FUMES.

3 pts. Formalin. 23 ozs. Potassium Permanganate.
For each 1000 cu. ft. Space.

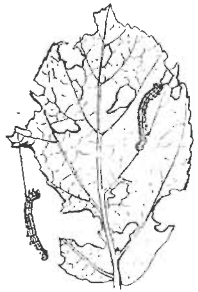
Place bulbs or tubers in 6 to 12 in. crates so fumes can get at them To prevent injury to potatoes, fill space at rate of 167 bu. Place formali in large pail in cleared central space and drop in the crystals of potassiun permanganate. Close room air-tight for 24 to 48 hours.

INSECT AND FUNGOUS PESTS OF CULTIVATED PLANTS.

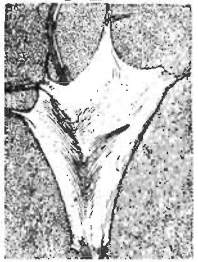
APPLE.

Insects, etc.

Bud-Moths: Case Bearers: Leaf Crumpler:—Small over-wintering caterpillars feed upon the unfolding leaves. Spray with lead arsenate as soon as leaf buds begin to open. Repeat a few days later, if necessary. Rept. 1909, p. 353.

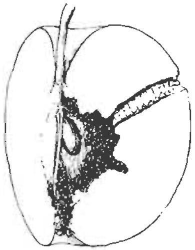


Canker-Worms—During May small looping caterpillars devour the leaves and spin down on threads when disturbed. Spray foliage with lead arsenate before blossoms open, and again soon after they fall. In unsprayed orchards sticky tanglefoot bands should be placed around trunks of trees in October, kept sticky until January 1st, and again kept sticky during April and May. Rept. 1908, p. 777.



Tent-Caterpillar—During May the caterpillars form nests at the forks of the branches, and devour the leaves. Clip off and burn egg masses on twigs in winter. Remove nests with caterpillar brush. Spray with lead arsenate once before the blossoms open and again soon after they fall. Bull. 177, and Rept. 1913, p. 226.

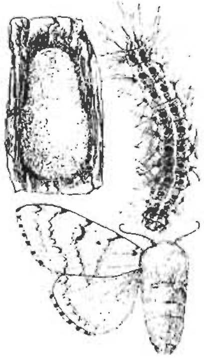
Lesser Apple Worm—Larva feeds on ex-



injury in storage. Spray twice as for codling-moth. Keep foliage and fruit covered until fruit is nearly grown. Rept. 1910, p. 595.

Codling-Moth or **Apple-Worm**—Pink caterpillar tunnels inside the fruit, especially around the core. Spray with lead arsenate as soon as the blossoms fall. Repeat three and six weeks later. Rept. 1910, p. 594.

Brown-Tail Moth: Fall Web-Worm—See Pear.



Gipsy Moth—Occurs in the United States only in south-eastern New England, New York and New Jersey. Brownish hairy caterpillars defoliate trees in May and June. Band trees with tanglefoot, and with burlap, which should be examined each day to destroy caterpillars. From August to May egg-masses can be destroyed by soaking them with creosote. Spray foliage with lead arsenate. Bull. 186; Repts. 1905, p. 246; 1906, p. 235; 1907, p. 300; also placard.

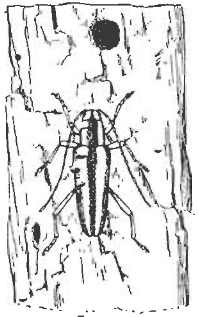
Curculios—Grubs of both apple and plum curculios infest the fruit, making it gnarled and ill-shaped. Spray twice after blossoms fall as for codling-moth, and remove infested fruit in thinning. Keep fence rows clear of trash. Rept. 1904,

as for codling-moth.

Tussock Moths—Tufted caterpillars of several species feed upon the leaves in mid-summer. Spray with lead arsenate as for codling-moth. Rept. 1905, p. 230; 1907, p. 332; 1916, p. 105; 1917, p. 325.

Yellow-necked Caterpillar: Red-humped Caterpillar—Feed in clusters and often strip young trees in fall. Hand-picking is easy method of control. Spray leaves with lead arsenate. Rept. 1901, p. 274; 1917, pp. 328, 329.

Maggot or **Railroad Worm**—Maggots tunnel through the pulp of the ripening fruit of sweet and sub-acid varieties, especially those ripening early in the season. Destroy all infested fruit. Adult flies may be killed by late sprays of lead arsenate. Rept. 1910, p. 593.



Round-Headed Borer: Flat-Headed Borer—Grubs burrow in wood at base of trunks. Watch trees and dig out borers wherever sawdust appears. Paint trunk with lead arsenate and lime-sulphur. Rept. 1907, p. 333.

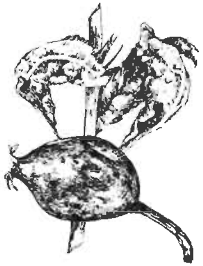
Leaf Hoppers—Whitish insects sucking sap from underside the leaves. Spray with nicotine solution, as for aphis.

Tarnished Plant Bug—Injures developing fruit by sucking sap, forming dimples. Spray with nicotine solution as for aphis.

Red Spider: Clover Mite: European Red Mite—Cause much injury to leaves, especially in dry seasons. Overwintering eggs killed by winter spray of lime-sulphur.

shoots, causing leaves to curl and checking growth. Rosy aphids infest fruit clusters, checking development. Use delayed dormant spray with nicotine solution ($\frac{1}{2}$ pint in 50 gallons water), either separately or in combination with lead arsenate, lime-sulphur or Bordeaux mixture. Repts. 1903, p. 259; 1909, p. 343.

San José Scale—See Peach. Spray dormant trees with lime-sulphur or miscible oil. Bull. 165; Rept. 1904, p. 221.



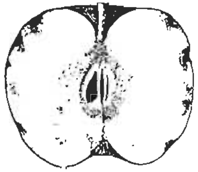
Red Bugs—Two species of red leaf bugs suck the sap, causing leaves and fruit to become distorted. Spray with nicotine solution, as for aphis throwing the spray against the tree from opposite directions at the same time. Rept. 1917, pls. II-III.

Woolly Apple Aphis—A bluish-white, cottony plant louse in colonies on bark, forming galls or swellings on twigs of small trees, and preventing wounds from healing; also on roots, forming galls, and destroying small feeding roots. Plant only clean or fumigated stock. Soak soil with carbon disulphide, ½ ounce in 4 gals. water. Spray above ground with kerosene emulsion.

Oyster-Shell Scale: Scurfy Scale—Scale insects with elongated or pear-shaped shells, on bark, suck sap from the twigs; the former about the same color

as the bark, the latter light gray or whitish. Spray with nicotine solution; soap and water; or kerosene emulsion, about the second week in June. Bull. 143; Rept. 1903, p. 225.

Fungi, etc.



Baldwin Spot—Shows as small diseased masses of brownish tissue, usually a short distance beneath the skin; finally may appear at the surface as small, discolored, shrunken areas, then very similar in appearance to some of the fruit speck troubles. Not a fungous, but apparently a physiological disease. Thought by some to be due to unusual local loss of water; similar troubles may start from punctures of rosy aphis or other puncturing insects. No remedy known, except possibly irrigation in the west.

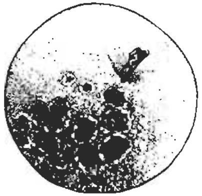
Cankers—Occur on branches and are caused chiefly by European canker fungus which eventually forms a cavity surrounded by concentric elevated rings of wood extending to bark, which each year is killed a little further, adding another ridge. Cut off infected branches, or cut out infected wood and bark; paint over cut surfaces. Keep orchard well sprayed and trimmed. Rept. 1903, p. 299.

Black Rot—Causes mature fruit to rot, eventually turning it black; forms small brown spots on leaves; does some damage through cankers on branches, which are eventually killed. Treat as for scab; prune and burn all dead limbs and twigs; cut out and paint over large cankers when found. Rept. 1909-10, p. 590.

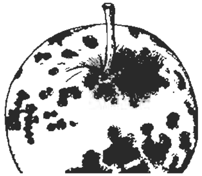
Fruit Specks—...

light-skinned varieties. Usually controlled by spraying as for scab. Late spraying is important. Rept. 1909-10, p. 590.

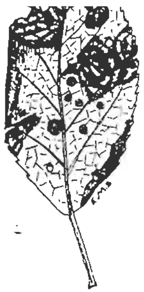
Rust—Shows as orange-colored blotches on leaves, eventually producing minute fringed clustered-cups imbedded on the under side; less frequent on fruit. Rust spreads to the apple from the *cedar-apples*, which appear in the early spring on the red cedar. All cedars near the orchard should be destroyed. There is great difference in the susceptibility of different varieties to this disease. Spraying is only partially successful in this state, as the leaves must be well coated continuously with spray from the time they begin to unfold, until the end of July. Repts. 1891, p. 161; 1909–10, p. 591.



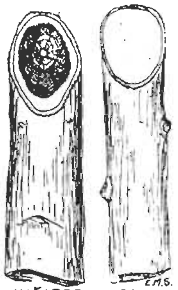
Scab—Produces "scabby spots" on fruit and leaves; rarely on twigs. Spray the unfolding leaves before the blossoms open, again after the petals fall, and follow with a third spraying about four weeks later. For first treatment, use strong Bordeaux, for second and third, weak Bordeaux or lime-sulphur or the latter for all three treatments. Very susceptible varieties sometimes need four treatments, the last two at intervals of about two weeks. Rept. 1909-10, p. 591.



Sooty Blotch—Forms on fruit an olive-black superficial growth in distinct round colonies, or often merging together. Spray with Bordeaux as for scab, or with lime-sulphur $1\frac{1}{2}$ to 50. The sprayings after blossom-



on after second and later sprayings. Worst in wet seasons. Spraying in bright sunshine may cause some scorch of fruit on sunny side. Varies greatly with different sprays. Avoid those known to be injurious or injurious combinations (as soap and lead arsenate); use Bordeaux only for *first* summer treatment or on varieties not especially subject to russeting. Rept. 1911, p. 360.



Winter Injury—Takes various forms from different conditions, such as imperfect fertilization or russeting of fruit following late spring frosts; sun scorch of trunks due to mild winter weather followed by sudden cold; bud and twig killing, frost cracks in trunks, blackened woods, dead roots, etc., following unusually cold winters or unfavorable environment. Set out only hardy varieties; avoid planting in wet ground or on hillsides with extreme south or southwest slopes. Head trees low; avoid late fertilization and cultivation; keep earth tight around trunks; use cover crops. Rept. 1903, p. 303; 1906, p. 310; 1914, p. 6.

Storage Rots—Are troubles caused by a variety of fungi. Store fruit, in a dry condition, in a cool, well-aired place. Do not store in too deep piles or too tight receptacles. Use poorer keeping varieties first, and sort over if necessary. Apples from well sprayed trees keep best. Rept. 1915, p. 426.

General Treatment for Apple Orchards.

For the general control of fungi and insects on apples in Connecticut we make the following recommendations:

blister mite, when commercial lime-sulphur, 1-8, or miscible oils, 1-15, may be used.

(2) As a rule, three summer treatments with a fungicide are necessary to control fungous diseases, and the last two of these should contain an insecticide. These sprayings should be made as follows: 1st, just before the blossoms open, on the young unfolding leaves (April 27th to May 10th, according to the season and variety); 2nd, as soon as all the blossoms have fallen (May 10th to 30th); 3d, about one month later (usually June 10th to 25th).

(3) Where fungi are not prevalent, especially scab, the first summer treatment may be omitted. Occasionally, perhaps in alternative years, where fungi are quite inconspicuous, the fungicide may be entirely omitted, and only the two sprayings with lead arsenate for insects given. With certain fungi and insects a fourth summer spraying is desirable.

(4) For fungicides, we recommend Bordeaux mixture of the 4-4-50 strength for the first spraying, and of the 1-4-50 strength or lime-sulphur for the later sprayings; or lime-sulphur, used at a strength of $1\frac{1}{4}$ to $1\frac{1}{2}$ gallons per fifty gallons of water, for all three sprayings. The former has better fungicidal value, and the latter is less likely to produce spray injury, especially russeting of the fruit. Where fungi are prevalent, the former might be used, while with varieties russeting badly, as Baldwin, the latter is likely to prove more satisfactory in the second and third summer treatments.

(5) For the insecticide in the above, use lead arsenate, if in the paste form at the rate of three pounds per fifty gallons of the mixture, or if in the powder form one and one-half pounds per fifty gallons.

(6) If canker worms, tent-caterpillar, bud-moth, or brown-tail moth are causing damage, add lead arsenate to the first

summer treatment, and if aphids are present nicotine solution should also be included. Nicotine solution may be added to any of the subsequent treatments to detroy aphids, red bugs, tarnished plant bug, etc

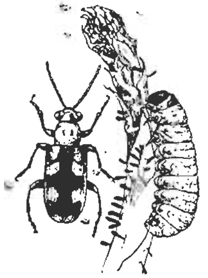
Insects.

ASH

Oyster-Shell Scale—See Apple.

Insects.

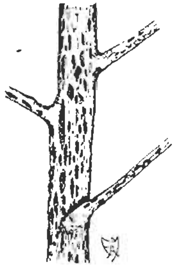
ASPARAGUS.



Asparagus Beetles, Common and **12-spotted**—Adults and larvae devour the foliage. Cut everything clean during the cutting season; afterward spray with lead arsenate. Repts. 1902, p. 172; and 1903, p. 276.

Asparagus Miner—Larvae tunnel under epidermis of stem near base, causing premature death of plant above ground. Burn infested stalks. Rept. 1906, p. 303.

Fungi.

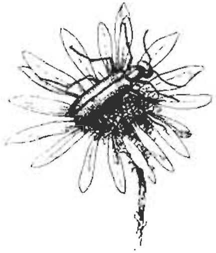


Rust—Produces (most conspicuous stages) small reddish or black elongated pustules scattered over stems. In fall, carefully gather and burn all stems from affected beds and escaped plants in vicinity. In gathering for market cut below the ground, as protruding stems offer opportunity for development of first stage of the fungus. Spraying with resin Bordeaux partially controls the disease, but this is difficult and expensive. Begin spraying the latter part of July and repeat about every 10 days until the middle of September. Thorough cultivation and fertiliza-

new stock from resistant individuals if found. This disease is not so serious as it was some years ago. Repts. 1896, p. 281; 1904, p. 313.

Insects.

ASTER.



Blister Beetles—Three or four species feed upon the flowers, the black one being commonest. Practice hand-picking and cover choice plants with mosquito netting. Bull. 208, p. 110.

Fungi, etc.

Yellows—Shows in the yellowed and often imperfectly developed foliage and one-sided blossoms. A physiological trouble whose cause is not definitely known. Buy best seed; transplant only healthy plants, and have soil conditions good. Repts. 1903, p. 306; 1914, p. 413 (26).

BARLEY.

Insects.

Army Worm—See Grass.

Fungi.

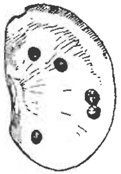
Rusts—See Oats and Wheat.

Smuts—Are of two kinds, covered and loose, both largely destroying the infected spikes and changing them into black, sooty structures, in the latter kind easily dissipated. Treatment, see Oats and Wheat.

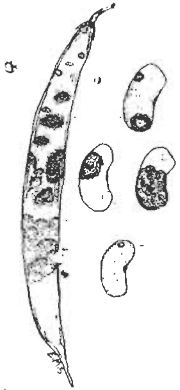
BEAN.

Insects.

Green Clover Worm- Occasionally green, wriggling caterpillars riddle the leaves in June and July. Dust string beans with air-slaked lime or other fine powder. Spray shell beans with lead arsenate. Repts. 1908, p. 828; 1919, p. 165.



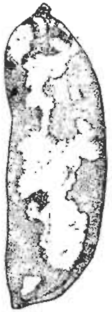
Weevils- Adults lay eggs in the pods in the field and continue to breed in the dried seed, finally rendering it unfit for food or for planting. Fumigate the seed with carbon disulphide, store in air slaked lime, or heat in oven for 1 hour between 120° and 150° F. Bull. 195, p. 6.



Fungi.

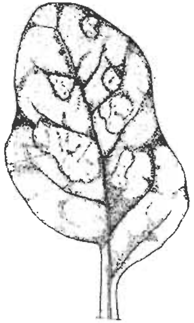
Anthracnose—Shows on leaves and pods as roundish discolored areas, often with a purplish border. Save seed from pods showing no spots and plant these by themselves, selecting each year seed from unspotted pods for the seed crop and using remainder for general crop. Destroy all infected seedlings. Where very troublesome spray with Bordeaux, beginning when plants are only a few inches high and repeating about every 10 to 14 days until pods are forming. Rotation and destruction of old vines may prove helpful in keeping the trouble in check.

Blight—Appears much like anthracnose, but with discolored areas usually having more of a translucent or watery character. Treat same as anthracnose. Repts. 1898, p. 262; 1903, p. 307.



Downy Mildew—Forms dense, white, woolly growths on pods and less luxuriantly on young stems and leaves of the Lima bean. As the fungus usually appears first and most vigorously in low moist places, the land used should be high or well drained. Serious only in years unusually moist after the middle of July. Spray with Bordeaux beginning about the middle of July, and repeat every 10-14 days until the middle of September Rept. 1905, p. 278.

Rust- -Produces small, round, reddish or black, dusty outbreaks, usually on the leaves Plant varieties not likely to rust. Burn the old infected plants in the fall. Rept. 1903, p. 308



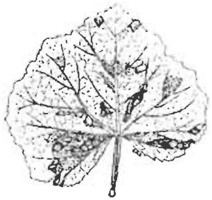
BEET-CHARD.

Insects.

Leaf-Miner--A small fly lays eggs in the leaves, and the larvae tunnel or mine between upper and lower surfaces. Practice clean cultivation. Destroy all infested leaves. Destroy all plants of the weed known as "lamb quarters" in which this insect breeds. Practice late fall plowing.

Fungi.

Leaf Blight- -See Mangel. Rept. 1903, p. 309



BEGONIA.

Eelworms.

Leaf-Blight Eelworm—Produces conspicuous dead areas on the leaves of Begonias (especially var. *Cincinnati*), ferns etc. Spots vary in size and shape according to host and disposition of larger veins.

Buy healthy stock only; keep infected plants by themselves and give them plenty of room; keep leaves as dry as possible and pick off and burn worst infected. Rept. 1915, p. 455.

BIRCH

Insects.

Tussock Moths—See Apple, Hickory, and Horse Chestnut.

Birch Leaf-Skeletonizer or **Birch Bucculatrix**—Small greenish-yellow larvae feed upon both sides of the leaves in late summer, often entirely defoliating the trees. Spray with lead arsenate in July. Rept. 1910, p. 701.

Bronze Birch Borer—Grub makes spiral tunnel just beneath bark of upper main branches, ridges showing on outside. Cut and burn infested trees before May 1st.

BLACKBERRY.

Insects.

Blackberry Crown Borer—Larva tunnels in roots and at base of stem. Dig out and destroy.

Red-Necked Cane Borer—Larva tunnels in canes causing an irregular swelling or gall, often three inches in length. Cut and burn all infested canes in winter or early spring.

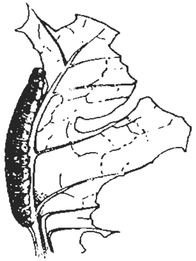
Blackberry Sawfly—Larvae devour leaves in June and first part of July. Spray with lead arsenate when young larvae appear. Rept. 1912, p. 236.

Fungi, etc.

Crown Gall—Forms hard galls or irregular excrescences on roots and lower parts of stems of blackberries, raspberries and several other hosts. Dig out and burn affected plants as soon as discovered. Never use infected stock for transplanting. A bacterial trouble. Rept. 1903, p. 354.

Leaf Spot—Forms on leaves small circular spots with whitish center and purplish border; also occurs on dewberry and raspberry. Not usually serious but where necessary it probably can be controlled by Bordeaux applied to the leaves, beginning before they have reached their full size. Rept. 1903, p. 309.

Orange Rust—Breaks out in spring or early summer as dusty masses of bright orange spores over the under side of the leaves. The fungus is perennial in the underground parts of the host, so that the disease appears year after year. Dig up and burn infected plants. Rept. 1903, p. 309.



BOX.

Insects.

Leaf-Miner—A small two-winged fly lays eggs in the leaf and the larvae tunnel between the upper and lower surfaces. Destroy infested leaves.

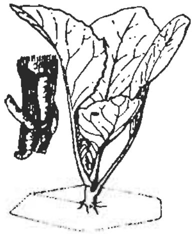
Oyster-Shell Scale—See Apple.

CABBAGE-CAULIFLOWER.

Insects.

Cabbage Worm—Green worms feed upon leaves all through season. Spray unheaded plants with lead arsenate. Use insect powder or hellebore on headed plants. Bull. 190, p. 9; Rept. 1903, p. 271.

Cabbage Looper—Smooth looping caterpillars feed with cabbage worms late in



summer, and require same treatment. Bull. 190, p. 12; Rept. 1910, p. 706.

Cabbage Maggot—Infests stems of early-set plants near surface of ground checking growth and often killing them. Practice crop rotation. Place hexagonal tarred paper disks around stems at setting time. Treat with carbolic acid emulsion. Bull. 190, p. 3; Repts. 1908, p. 832; 1914, p. 142; 1915, p. 114.

Cabbage Aphis—Sucks sap from the leaves. Spray with nicotine solution and soap or with kerosene emulsion. Bull. 190, p. 14.

Fungi, etc.

Black (Bacterial) Rot—Forms black lines in veins of leaves. In time leaves turn yellow and easily drop off, and interior of head develops a general soft rot. As the germs can be carried on the seed, avoid seed from infected fields. If in doubt, treat seed in formalin, 1 part to 240 of water for 15 minutes. Keep refuse from diseased plants out of manure; practice rotation; make seed bed in new soil if disease appears in old one. Rept. 1912, p. 345.

Club Root—Causes knob-like enlargements on the roots of cabbage and allied plants. The germ often becomes established in the soil; when possible avoid such land and the use of refuse from old plants on the soil. Be especially careful that the seed bed is not infected. Infected land, if used, should be treated in the fall with lime broadcast at the rate of 80 bushels per acre and worked in. Rept. 1903, p. 310.

CARNATION.

Insects.

Green Fly or **Aphis**—Sucks sap from young leaves and buds. Fumigate greenhouse with tobacco, or spray with nicotine solution and soap, or with soap and water.

Fungi.

Leaf Mold and **Leaf Spot**—Are two troubles much alike in appearance, producing grayish spots with colored borders on stem, leaves and calyx. Treat as for Rust.

Rust—Produces small dusty pustules, more or less confluent, on the leaves and stems. Select, if feasible, only rust-resisting varieties. Spray in field with Bordeaux, adding $1\frac{1}{2}$ lbs. soap to each 50 gallons (helps mixture to adhere to plants). Select for transplanting only hardy and rust-free specimens. Keep air of greenhouse as dry as is consistent with good growth. One or two sprayings with Soap- or Resin-Bordeaux, after transplanting in greenhouse, may be given if desired; for repeated sprayings use potassium sulphide or weak copper sulphate. Rept. 1903, p. 312.

Stem Rot and **Wilt**—Cause the lower leaves first to turn yellow and dry up; then as the stem gradually rots off at its base, the whole plant becomes affected and finally dies. Select cuttings only from perfectly healthy plants, and if necessary start these in sterilized soil and replant out of doors in new land, avoiding excessive use of manure. If disease appears after setting out in the greenhouse, pull up infected plants upon appearance of first symptoms, make liberal application of lime, avoid over-watering and see that roots are properly aerated. Repts. 1897, p. 175 1903, p. 312.

CEDAR.

Insects.

Web-Worm—Small brown caterpillars feed upon the leaves which they web together. Spray with lead arsenate.

Fungi.

Cedar-Apple Rust—Appears in spring as conspicuous rounded galls with jelly-like horns bearing spores that carry the fungus to apple and related hosts. Cut off and burn all *cedar-apples* if undesirable to destroy the trees. See Apple Rust.

CELERY.

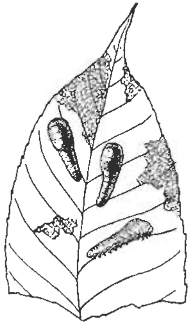
Insects.

Celery Caterpillar—Feeds upon the leaves of celery, parsley, fennel, carrot and parsnip. On the latter two plants lead arsenate may be used. On celery and parsley hand picking is perhaps the best remedy.

Fungi.

Leaf Blight and **Leaf Spot**—Are two diseases showing "rusty" spots on leaves and petioles; the latter trouble distinguished by the very *minute* black dots in the discolored spots (fig.), often progressing in stalks after storage. Spray the plants thoroughly in the seed bed with Bordeaux, as infected plants are often the means of introducing the trouble in the field. If necessary, continue the spraying after transplanting at intervals of about two weeks up to the middle of September. Before covering for bleaching, if leaf spot is abundant, dust with sulphur, and before final storage remove infected leaves and dust again. Rept. 1897, p. 167.

Soft (Heart) Rot—Shows as a soft rot of the tissues often confined to the heart. Do not plant in too wet soil, avoid land with green cover crops recently plowed in; in banking allow for proper aeration. See Salsify. Rept. 1914, p. 10.



CHERRY.

Insects.

Cherry or **Pear Slug**—Larvae eat away the green tissue from upper side of leaf. Spray or dust with lead arsenate and sulphur.

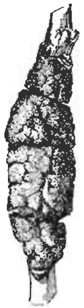
Canker Worms—See Apple.

Cherry Maggots or **Fruit Flies**—Larvae of two species infest maturing fruit. Sprinkle foliage with sweetened lead arsenate in early June to kill the adult flies.

Plum Curculio—See Plum..

Cherry Aphid—A brown aphid which sucks sap from under side of leaves causing them to curl. Spray with nicotine solution and soap, soap and water, or kerosene emulsion.

Fungi.



Black Knot—Forms knot-like excrescences, usually several inches long, on twigs and branches. When planting, use only trees free from this trouble; in the orchard, cut off and burn all infected branches in late fall or winter, painting over large cut surfaces. Cutting *out* knots is rarely advisable, as new outbreaks usually result. In cutting off, cut several inches below the knot, to insure removal of the mycelial threads in the tissues. Remove all knots each year until they fail to reappear. Spraying in spring and early summer with self-boiled lime-sulphur or atomic sulphur helps to keep

new knots from fruiting, but is entirely secondary in importance to the removal of the knots. Rept. 1911, p. 399.

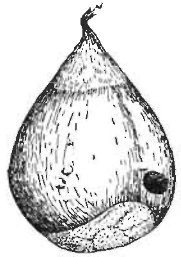
Brown Rot—See Plum. Rept. 1911, p. 402.

Leaf Spot—Shows as numerous, closely placed, purplish spots on leaves, which often have "shotholes." Spraying, if begun on young leaves early in May, is effective but use the dilute Bordeaux, or better still, self-boiled lime-sulphur or atomic sulphur to avoid injury to the foliage. Give several sprayings at intervals of two weeks. This helps to keep down the brown rot also. Repts. 1895, p. 188; 1911, p. 401. Also known as anthracnose.

Powdery Mildew—Develops a cobweb-like growth over the leaves; in fall forms numerous, minute, black fruiting-bodies, especially on under surfaces. Usually worst in young trees; controlled by spraying if necessary.

CHESTNUT-CHINQUAPIN.

Insects.



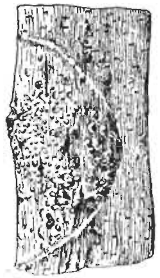
Canker Worms—See Apple.

Nut Weevils—Long-nosed snout beetles lay eggs in developing fruit and the grubs infest the nuts. Destroy all infested nuts. Fumigate nuts with carbon disulphide as for beans.

Two-lined Chestnut Borer—Long, slender, flat-headed larvae make sinuous tunnels under bark of weakened chestnut and oak trees. Badly infested trees should be removed and burned, or the bark removed before the insects mature and spread to other trees.

Fungi.

Bark Disease (Blight)—Forms cankers in the bark that eventually girdle infected limb and cause death of parts above. Spreads over tree so that usually it dies within two to five years.



Rarely shade trees can be saved by carefully cutting out and painting over the cankers. For forest trees it is best to let the disease take its course, and remove at least the larger trees within a year or two after their death to prevent deterioration of the wood. Most of the chestnuts in the state have been already killed. Rept. 1912, p. 359; Bull. 178.

CHRYSANTHEMUM.

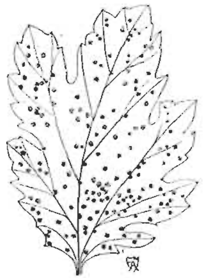
Insects.

Black Fly or **Aphis**—Sucks the juice from the young leaves and flower stems. Fumigate the house with tobacco; dip the plants in or spray them with soap and water or nicotine solution and soap.

Gall Midge—Larvae form cone-shaped galls on leaves and new shoots. Spray plants about three times each week with nicotine solution and soap. Rept. 1919, p. 161.

Fungi.

Powdery Mildew—Develops a white mealy or cobweb coating on leaves. Use good judgment in airing and watering, and if necessary, spray from time to time with potassium sulphide or paint heating pipes with sulphur.



Rust—Appears as dusty reddish-brown outbreaks, about the size of a pin head chiefly on under sides of leaves. Avoid worst rusting varieties. Start with cutting free from rust. Destroy rusted leaves, especially on cuttings. Early sprayings with dilute copper sulphate, potassium sulphide etc., may help to prevent the trouble from getting a start. Rept. 1903, p. 315.

CINERARIA.

Insects.

Aphis or **Green Fly**—Sucks sap from the leaves and stems. Use nicotine solution and soap, or soap and water, as a spray or dip.

CORN.

Insects.

Cut Worms—See Tomato.

Army Worm—See Grass.

Stalk Borer—See Dahlia.

White Grubs—See Grass.

Corn Ear Worm—Eats the immature kernels at the end of the ear. Dust the silk with equal parts sulphur and powdered lead arsenate. Rept. 1919, p. 188.

European Corn Borer—Imported into eastern Massachusetts, New York and Canada. Larvae tunnel in all parts of plant above ground. Destroy all infested plants. Rept. 1918, p. 316.

Fungi.

Leaf Blight—Kills parts of the leaves in August and September much like an early frost. Most injurious in wet late seasons. Plant early maturing varieties and stimulate growth by good fertilization and cultivation. Rept. 1903, p. 317.

Root and **Ear Rots**—Injures roots and base of stalk with a reddish-brown rot. Stalks are easily broken off and often fail to produce good ears, the worst infected showing a moldy, white or pinkish growth. Plant only vigorous, disease-free seed, practice yearly rotation and do not let corn follow other grains. Bull. 222, p. 427.

Smut—Forms black dusty outbreaks th appear on various parts of the plant. is especially injurious to certain varieties sweet corn. Avoid the use of fresh manu on the land. Seed treatment is ineffectiv The removal and destruction of spore mass is recommended by some writers.

CRANBERRY.

Insects.

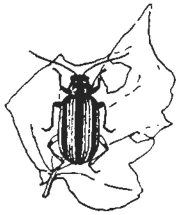
Fireworm or **Black-headed Cranberry Wor** - Small, pale green, black-headed caterpilla web the leaves and new shoots together and feed inside tl nest. Spray with lead arsenate to kill the caterpillars. Floc the bog for three days to kill the pupae.

Yellow-headed Cranberry Worm—Small, green yellow-heade caterpillars injure plants in same manner as the preceding. Spra with lead arsenate. Keep bogs flooded until about May 20.

Cranberry Fruit Worm—Pale green larvae infest the berrie Flood the bog for about two weeks as soon as the fruit has bee harvested. Destroy all infested berries.

CUCUMBERS.

Insects.



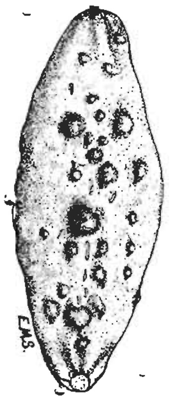
Striped Cucumber Beetle—Attacks youn plants, eating the leaves. Larvae infest th main root or stem under ground, often killin the plant. Dust leaves with dry lead arsenate Cover plants with screens. Bull. 216, p. 34 Rept. 1908, p. 807.

Melon Aphid—See Melon.

Fungi, etc.

Anthracnose—Produces prominent discolored spots, more or less merged, on leaves; occurs occasionally on fruit. Treatment is the same as for mildew. See Watermelon.

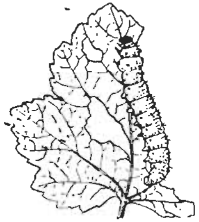
Downy Mildew—Forms discolored spots as in preceding, but beneath shows a minute thin growth of upright threads bearing dark colored spores. Repeated sprayings with Bordeaux about every 10 to 14 days during the season, beginning at least by middle of July, usually keeps this disease in check. The same fungus occurs on Melons. Rept. 1904, p. 329.



Mosaic and **White Pickle**—Are two very similar, if not identical, physiological diseases, showing in the former on the leaves as mottling of lighter or yellow-green areas scattered among the normally green tissues, and in the latter causing the fruit to become irregularly shaped, knobbed, and often mottled or whitish in color. Keep down sucking insects that may spread the disease, as it is infectious; pull up and destroy vines first showing it. Rept. 1915, p. 430.

Wilt—See Squash.

CURRANT.



Insects.

Currant Fruit Fly—Small maggots infest the berries, which color prematurely and drop. Destroy infested fruit.

Currant Worm—Devours foliage in May. Spray with hellebore or lead arsenate. Rept. 1902, p. 170.

Currant Borers—The larvae of two species of insects tunnel in the pith of the stems, causing the ... droop and wilt. Destroy infested canes during May.

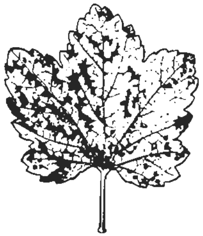
Currant Stem Girdler—Adults cut or girdle tip of new shoots after laying eggs in them. Cut and burn these tips at any time of year. Rept. 1896, p. 238.

Currant Aphids—Yellowish-green aphids on under side of leaves causing them to curl. Underspray with nicotine solution or kerosene emulsion.

Four-Lined Leaf-Bug—A yellow and black striped bug sucking sap from the leaves. Spray with nicotine solution and soap. Bull. 208, p. 118.

San José Scale—See Peach.

Scurfy Scale—A conspicuous pear-shaped light-gray scale on bark, the insect sucking sap from twigs. Spray about second week in June with kerosene emulsion or nicotine solution and soap. Bull. 143; Rept. 1903, p. 227.



Fungi.

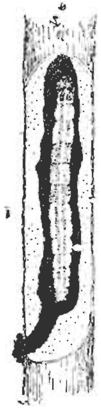
Anthracnose and **Leaf Spots**—Cause spots on the leaves and usually their premature shedding; the former also spots the fruit of certain varieties. Spray with Bordeaux as the leaves unfold, and repeat at intervals of 10 to 14 days until fruit begins to turn. If necessary continue spraying after harvest. Rake up and burn leaves in fall.

Blister Rust—Shows first as dusty orange-colored outbreaks about size of pinhead on lower surface of leaves, and later as short hair-like growths. Worst on black currants. Alternate host is white pine. Report presence to the Experiment Station Rept. 1911-12, p. 347. See Pine.

CYCLAMEN.

Insects.

Leaf-Mite—Transparent microscopic mites cause leaves to curl, and plants do not blossom. Syringe under leaf surface strongly with water. Spray with, or dip plants in nicotine solution and soap, 1 part in 400 parts of water. Avoid excessive moisture in house. Rept. 1914, p. 176.



DAHLIA.

Insects.

Tarnished Plant Bug—Sucks the sap from the stems and buds causing them to fall. Spray with nicotine solution and soap. Rept. 1904, p. 218.

Stalk Borer—Larva tunnels up and down inside the main stem, the top portion usually wilting and dying. Carefully make longitudinal slit in the stem and kill the borer. Bull. 208, p. 111; Rept. 1919, p. 180.

EGG-PLANT.

Insects.

Flea Beetle—See Potato.

Colorado Potato Beetle—See Potato.

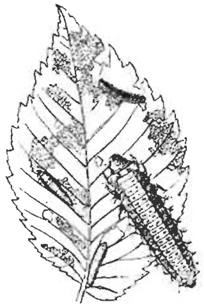
Fungi.

Fruit Rots—Caused by several fungi, the gray mold producing the most extensive rot. Spray with Bordeaux; pick off and carry away the rotting fruit.

ELM.

Insects.

Spiny Elm Caterpillar—Clusters of black spiny caterpillars often strip certain branches of elm, willow, and poplar. Remove and destroy entire cluster, or spray with lead arsenate. Rept. 1906, p. 260.



Elm Leaf Beetle—Adult beetles eat holes through the leaves in May, and in June and July the larvae or grubs eat away the green tissues from the under surface. Spray with lead arsenate early in May to kill egg-laying beetles, or spray under surface of leaves with same mixture about June 1st, to kill the larvae. Yellow pupae at base of trees may be killed with kerosene emulsion or soap and water. Bull. 155; Rept. 1908, p. 815.

Canker Worms—See Apple.

White-Marked Tussock Moth—See Horse Chestnut.

Leopard Moth—Larvae tunnel in branches under the bark, cutting deep galleries, often girdling the branch, which later breaks off and falls to the ground. Small trees may be examined and borers killed by injecting carbon disulphide, or by inserting a wire. Bull. 169; Rept. 1911, p. 317.

Elm Scale—A large brown soft scale, oval in shape with cottony marginal fringe, located especially in the cracks of the bark of trunk and lower branches, sucking the sap. Spray with keroser emulsion. Bull. 151; Rept. 1905, p. 235.

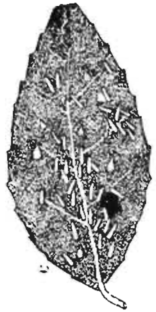
White Elm Scale—A whitish pear-shaped scale on twigs. Spra about June 10th with kerosene emulsion.

Elm Woolly Aphids—Several species curl the leaves, or form i cottony masses on the bark. Spray with kerosene emulsion.

Fungi.

Leaf Spot—Shows as black slightly elevated specks more (less thickly imbedded in the leaves and causing their prematu fall. Not usually so injurious as to merit the expense of sprayin with Bordeaux, which should start on the immature leaves. Rep 1909-10, p. 717.

EUONYMUS.



Insects.

Euonymus Scale—The various species of Euonymus are attacked and often injured by this scale, which has narrow white (male) or pear-shaped gray or brown (female) shells. Cut and burn infested twigs. Cover and fumigate with hydrocyanic acid gas. Spray with nicotine solution or kerosene emulsion during June to kill young. Bull. 151; Rept. 1905, p. 240.

FERN.

Insects, etc.

Woolly Bears—Several kinds of light brown hairy caterpillars devour the fronds in late summer. Spray with lead arsenate.

Hemispherical Scale—Brown, oval convex scales on fronds of plants under glass. Apply soap and water or nicotine solution as a dip or spray. Bull. 151, p. 9; Rept. 1905, p. 239.

Leaf-Blight Eelworm—See Begonia.

GERANIUM.

Insects.

Greenhouse Leaf-Tyer—Small green wriggling caterpillars feed upon the leaves of plants under glass. Spray with lead arsenate.

White Fly—See Tomato.

Leaf Mite—See Cyclamen.

Fungi.

Gray Mold Rot—Produces dead spots on leaves and blasts blossoms. Worst in poorly lighted and leaky greenhouses. Keep drippage off plants; avoid watering in cloudy or muggy weather; ventilate. Attacks as a semi-parasite a variety of greenhouse plants. Rept. 1903, p. 322.

GOOSEBERRY.

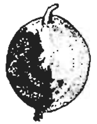
Insects.

Currant Worm—Devours foliage. Apply hellebore or lead arsenate early in season. Rept. 1902, p. 170.

Gooseberry Fruit-Worm—Feeds inside the berry. Destroy infested berries.

Currant Fruit Fly—See Currant.

Fungi.



Mildew—Forms a felt-like growth on fruit and leaves of young shoots. Worst on European varieties, also attacks currant, especially young shoots. Spray with potassium sulphide or other sulphur spray as soon as buds break, and repeat about every ten days until the end of June.

Blister Rust—Not common as yet on cultivated varieties. See Currant.

GRAPE.

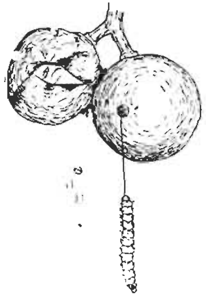
Insects.

Grape Vine Flea Beetle—Adults and larvae devour the leaves. Spray with lead arsenate the latter part of June.

Rose Chafer—Long-legged brown beetles appear about June 15th and feed upon leaves, flowers and newly set fruit, often doing great damage. Cover choice plants with netting. Spray heavily with lead arsenate just before blossoms open and if necessary again after fruit has set. Rept. 1916, p. 111.

Grape Plume Moth—Small green spiny caterpillars web together the newly formed leaves at the tips of new shoots. Damage more apparent than

real. Crushing by pinching these leaves is the best remedy. Rept. 1914, p. 190.

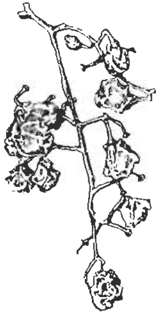


Grape Berry Moth—Larva feeds and develops inside the berries and is the cause of most wormy grapes. Spray with lead arsenate soon after fruit sets, and repeat twice at intervals of about ten days. Bag the clusters soon after the fruit sets.

Grape Root Worm—Adult beetles eat chain-like holes in leaves in July, and larvae or grubs devour the small feeding roots and eat channels in the bark of the larger roots and main stem underground, often causing great injury. Spray leaves with lead arsenate.

Sphinx and **Other Caterpillars**—Several species of horn worms as well as other kinds of caterpillars feed upon the leaves. Spray with lead arsenate or practice hand picking.

Grape Leaf-Hopper—Small, yellow and red-marked leaf-hoppers sucking sap from under side of leaves. Spray under surface with nicotine solution and soap.



Grape Phylloxera—Sucks sap from roots and leaves, forming galls, and causing serious injury to European varieties. Graft on native species.

Fungi.

Black Rot—Causes reddish-brown spots on leaves; more rarely on stems; especially bad in rotting the berries, which finally become hard, shrunken and wrinkled, black mummies. This is one of the worst diseases of the grape and often difficult to control by spraying, which must be thorough, especially the first season. Begin spraying before blossoming time, about the last of May, with second application just after blossoming and subsequent sprayings at intervals of about 10-14 days. Use Bordeaux up to the last of July and then change to Soda Bordeaux or Amm. Sol. Cop. Carbonate, though usually the 4 or 5 sprayings with Bordeaux are sufficient. Repts. 1889, p. 174; 1890, p. 100.

Downy Mildew—Develops usually dense white patches of fruiting threads on under side of leaves and causes more or less discoloration on the upper; also occurs somewhat on stems and fruit. Treat as for black rot. Rept. 1893, p. 77.

Gray Mold—Causes rotting of ripening greenhouse grapes, covering them with a more or less conspicuous grayish mat of fruiting threads. Remove rotting grapes from the house. Use care in ventilating and watering. If necessary spray bunches several times with potassium sulphide.

Powdery Mildew—Produces a cobweb-like growth over upper surface of leaves; most conspicuous in the fall, when the minute, round, yellowish to black fruiting-bodies are found scattered over surface. Treat as for black rot. Potassium sulphide is also used effectively against this fungus. Repts. 1895, p. 185.

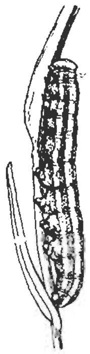
GRASS.

Insects.

White Grubs—White grubs are the larvae of June beetles, and when abundant in the soil and approaching maturity, cause much damage, especially in seasons following drought, by eating off the roots of grass, corn, strawberries, etc. Plow just before October 1st to expose insects. Harrow very thoroughly before planting. Repts. 1912, p. 288; 1915, p. 179.

Fall Army Worm—Attack similar to that of army worm but occurs in September instead of July, and is more apt to be ...

fined to lawns and millet. The worm does not migrate in such great numbers from one field to another. Same remedies apply. Also practice late fall plowing. Rept. 1912, p. 284.



Army Worm—In certain seasons grasses and grains are stripped of leaves and heads during July by brown striped caterpillars, which when abundant move like armies from one field to another often causing great damage. Spray with lead arsenate, strips of grass or grain to protect fields not attacked. Plow deep furrows across line of march, turning the furrow towards the line. Sprinkle migrating worms with kerosene. Use poisoned bran mash. Rept. 1914, p. 157.

HICKORY.

Insects.

Fall Web-Worm—See Pear.

Walnut Caterpillar—See Walnut.

Hickory Tussock Moth—White and black hairy caterpillars feed upon the leaves in late summer. Spray with lead arsenate. Repts. 1907, p. 332; 1917, p. 325.

Hickory Bark-Beetle—Small black beetles breed under bark and the galleries soon girdle the tree. Adults emerge, leaving numerous round holes as if the bark had received a charge of bird shot. Beetles also feed at base of compound leaf stems causing them to break and fall in midsummer. Has killed thousands of trees in Atlantic States. Badly infested trees should be removed before May 1st, and burned or at least the bark removed. Spray healthy and slightly infested trees about June 1st, with strong lead arsenate and nicotine solution. Repts. 1901, p. 267; 1914, p. 198.

Hickory Borer—Larvae tunnel deep into solid wood of trunk. Hunt for sawdust, find the burrow, inject carbon disulphide, and plug the entrance.

Nut Weevils—Larvae infest the fruit or nuts. See Chestnut.

Hickory Gall Aphid—Curious galls on the leaf stems often cause the leaves *to fall in midsummer. Galls contain large* numbers of aphids. Spray with nicotine solution just as new growth starts in spring. Rept. 1916, p. 145.

HOLLYHOCK.

Fungi.

Rust—Appears as small, compact, reddish-brown outbreaks on both leaves and stems. After their death in fall, cut off the plants close to the ground, carefully gather up these and any rubbish that may contain spores, and destroy them. Spraying with Bordeaux is recommended by some as helpful in checking the rust; begin as plants push through ground. Rept. 1895, p. 188.

HOP.

Insects.

Hop-Vine Borer—Larva tunnels in tip, checking growth, and later in the stem above and below the surface of the ground. Crush larvae in the tips, remove soil from the base, and after leaving the main roots exposed for a week, apply wood ashes or ammoniated phosphate and hill up. The plants will make new roots.

Hop-Vine Snout Moth—Green, white-striped larvae feed upon the leaves in June. Spray with lead arsenate while the larvae are small.

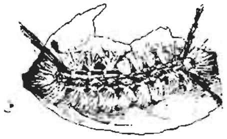
Hop-Merchants—Brown, spiny caterpillars of two species of tortoise-shell butterflies feed upon the leaves. Spray with lead arsenate.

Hop Aphid—Green aphids suck the sap from the under leaf surface. Spray with kerosene emulsion.

Fungi.

Powdery Mildew—Coats leaves and stems with whitish powdery growth, the mature fruiting bodies finally showing as loosely imbedded blackish specks. Found here so far only on ornamental varieties. Make several sprayings with commercial lime-sulphur. Rept. 1911-12, p. 349.

HORSE CHESTNUT.



Insects.

White-Marked Tussock Moth—Tufted caterpillars devour leaves in midsummer. Spray with lead arsenate. Repts. 1905, p. 230; 1916, p. 105.

Fungi.

Leaf Spot—Forms extended reddish-brown areas on the leaves, frequently resembling sun scorch, but showing the fruiting stage as minute black dots in the dead tissues. This trouble can no doubt be controlled by spraying with Bordeaux. The first application is made on the unfolding leaves and is followed by one or two subsequently at intervals of about 2 weeks.

HORSE RADISH.

Insects.

Flea Beetle—Adults feed on the leaves, and larvae tunnel in the petioles. Spray with Bordeaux mixture and lead arsenate.

IRIS.

Insects.

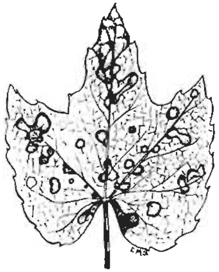
Iris Root Borer—Larva tunnels in the rootstocks injuring many plants. Destroy infested rootstocks. In bad infestations burn over the beds in winter to destroy the eggs. Repts. 1915, p. 189 1918, p. 331.

Fungi, etc.

Leaf Blight—Forms elliptical spots with purplish border; i abundant causes leaves to turn yellow and die prematurely worst on German Iris. Keep foliage coated with Bordeaux o lime-sulphur, beginning early; gather and burn infected rubbisl in late fall.

Soft Rot—Attacks rootstocks destroying lower parts so tha leaves turn yellow and die. Same bacterial disease describe under Salsify. Propagate only from healthy stock; plant ir well drained soil; use only well rotted manure; prevent winte injury of roots. Rept. 1903, p. 327.

IVY, BOSTON.



Fungi.

Leaf Spot—Forms conspicuous brownisl spots with purplish borders, which ru together if abundant. Leaf stage of blacl rot of grape. Give several sprayings witl commercial lime-sulphur, beginning on unfolding leaves. Burn leaves in fall.

KALE.

Insects.

Turnip Aphid—See Turnip.

Fungi.

Black Rot—Rept. 1915, p. 431. See Cabbage.

LARCH.

Insects.

Larch Sawfly—Larvae defoliate trees in midsummer. Spray with lead arsenate. Rept. 1915, p. 125.

Woolly Aphid—White cottony tufts on the bark and at the leaf whorls. Spray with kerosene emulsion.

LETTUCE.

Insects.

Aphid or **Green-Fly**—Sucks sap from leaves. Fumigate with tobacco or hydrocyanic acid gas. Spray with soap and water.

Fungi.

Drop—Causes sudden wilting of plants by infecting and rotting off leaves at surface of soil; often shows a white moldy growth over the basal parts. This may develop into a serious trouble in the greenhouse, as the fungus often becomes established in the soil, when the best remedy is to change the soil entirely or sterilize it by steam or formalin (formula D). Treat some days before using. Parsley is also subject to this disease in the greenhouse. Rept. 1908, p. 863.

Leaf Mold and **Mildew**—The first produces a brownish and the second a white moldy growth in spots on the leaves. These diseases are held in check by sub-irrigation or care in watering and ventilating to keep plants and atmosphere as free from moisture as is consistent with good growth.

LILAC.

Insects.

Lilac Borer—A white larva tunnels in the twigs. Cut and burn infested twigs. Rept. 1905, p. 260.

Oyster-Shell Scale—See Apple.

San José Scale—See Peach.

Fungi.

Powdery Mildew—Forms whitish cobwebby coating on leaves, with mature stage finally abundant as black dots. Conspicuous and common, but hardly demands preventive treatment.

LILY.

Insects.

Aphid—Yellow plant lice with red markings, on under side of leaves. Spray with nicotine solution and soap.

Stalk Borer—See Dahlia.

LINDEN.

Insects.

Canker Worm—See Apple.

White-Marked Tussock Moth—See Horse Chestnut.

Linden Borer—A white larva tunnels in wood at base of trunk. Dig out borer, or inject carbon disulphide. Rept. 1915, p. 186.

LOCUST.

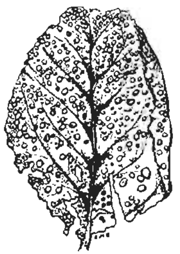
Insects.

Locust Borer—Larvae tunnel in solid wood of trunk. When new leaves appear, spray bark of trunk and larger branches with mixture made by dissolving ¼ lb. sodium arsenite in 5 gallons water to which 1 quart of miscible oil is added and the whole thoroughly agitated.

MANGEL.

Insects.

Leaf Miner—See Beet.



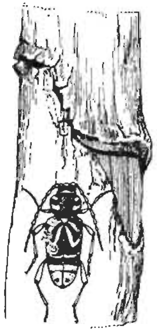
Fungi.

Leaf Blight—Shows as grayish circular spots with purplish borders; when abundant causes premature death of leaves. Rotate; keep refuse out of manure piles; if necessary spray with Bordeaux before disease gets started. Rept. 1915, p. 432.

Root Rot—Rots off roots below ground, turning foliage yellow and often killing it. Not common, but injurious occasionally in low wet fields. Avoid wet ground; keep rotted plants out of manure. Rept. 1915, p. 433.

Insects.

MAPLE.



Maple Borer—Larva tunnels in spiral course upward around trunk or larger branches of sugar maple working in sapwood and cambium, often girdling the trees. Examine trees in September for sawdust. Find the burrow, inject carbon disulphide and plug the opening. Rept. 1907, p. 336.

White-marked Tussock Moth—See Horse Chestnut.

Other Tussock Moths—See Apple.

Canker Worms—See Apple.

Woolly Maple Leaf Scale—Cottony or woolly masses of wax, containing the females, eggs and sometimes larvae, appear on the under side of the leaves in midsummer; insects suck out the sap causing leaves to fall prematurely. Males and larvae enter crevices of bark of trunk and branches; larvae make cases here and pass the winter. Attacks only sugar maples. Spray dormant trees with nicotine solution and soap. Burn all infested leaves. Bull. 151; Repts. 1905, p. 226; 1911, p. 345.

Cottony Maple Scale—Large, oval, brown soft scales on bark of branches of silver and red maples. Each scale in early summer develops a large cotton-like tuft of wax, nearly half an inch long, and soon after the young appear. Spray with miscible oils. Bull. 151; Repts. 1905, p. 237; 1913, p. 252.

Terrapin Scale—Small reddish-brown soft scales on small twigs of silver and red maples, sometimes killing the branches. Spray with kerosene emulsion. Bull. 151; Rept. 1905, p. 238.

Oyster-Shell Scale—See Apple.

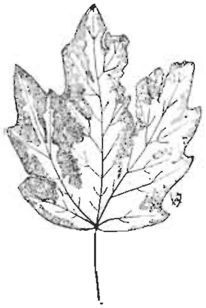
Maple Aphids—Green aphids are common on under surface of leaves of Norway and Sycamore maples in June. Spray with nicotine solution and soap, or with kerosene emulsion.

Gall Mites—Disfigure leaves by forming galls on upper surface. Destroy infested leaves.

Fungi, etc.

Anthracnose—Causes more or less extended dead areas in the leaves, often hard to distinguish from the leaf scorch. Its appearance depends on character of season and is difficult to foretell, but only occasionally serious. For this reason spraying is of doubtful value in the long run, but when made should start on the unfolding leaves. Repts. 1903, p. 329; 1915, p. 436, unusual form.

Black (Tar) Spot—Forms slightly thickened black spots on the leaves, resembling finger prints. Cut-leaf maples are especially susceptible. Rake up and burn all leaves in the fall. Rept. 1908, p. 852.



Leaf Scorch—Causes more or less extended and irregular dead areas to appear suddenly, usually from the leaf margins inward. A physiological trouble due to sudden or excessive evaporation beyond the supply of water furnished by the roots, which is in turn due to abrupt changes in atmospheric conditions, drought, injury to roots, etc. Pruning, when necessary, watering or mulching, and stimulating root growth by nitrogenous fertilizers are probably best remedial measures. Rept. 1905, p. 267.

Stag-head—Kills trees at the top or large central branches gradually die. Due to various agents or unfavorable environment such

as parasitic or semiparasitic toadstools and shelf-fungi, escaping gas in soil, winter injury, etc. Cut off dead and dying branches, clean out decaying wood, treat with a wood preservative and if necessary fill cavities. Stimulate new growth by nitrogenous fertilizers.

MARGUERITE.

Insects.

Marguerite Fly or **Leaf Miner**—A maggot tunnels between upper and lower leaf surfaces. Spray every ten or twelve days with nicotine solution. Rept. 1915, p. 188.

MELON (MUSK).

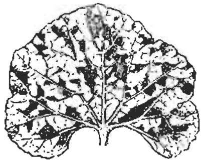
Insects.

Melon Aphid—Sucks the sap from the under side of the leaves, and when abundant causes much damage. Underspray the leaves with nicotine solution and soap. Bull. 216, p. 47; Rept. 1908, p. 313.

Striped Cucumber Beetle—See Cucumber.

Fungi.

Anthracnose—Appears occasionally. See Cucumber and Watermelon.



Downy Mildew—Forms angular, eventually brown spots in the leaves, often stunting or killing vines; most prominent just before melons ripen, later ones often not maturing or worthless because lacking flavor. It is questionable whether this trouble can be controlled effectively and profitably by spraying during a very moist season. During dry or semi-moist seasons, however, results are satisfactory, so we recommend spraying as one of the regular operations of melon growing. It should be started soon after the vines begin to run, at least by the middle of July, and the vines should be kept covered with the Bordeaux to the end of the season. Rept. 1904, p. 329.

Leaf Mold—Develops dead spots on the leaves very similar to those caused by downy mildew. Spray with Bordeaux on the first running vines and repeat every 10 to 14 days, making 4 or 5 applications according to season. Repts. 1895, p. 186; 1898, p. 225.

Wilt—See Squash.

MILLET.

Insects.

Fall Army Worm—See Grass.

NASTURTIUM.

Insects.

Aphid—Brown aphids cluster on stems and leaves sucking the sap. Spray with nicotine solution and soap.

OAK.

Insects.

Canker Worms—See Apple.

Brown-Tail Moth—See Pear.

Orange-striped Oak-Worm—Black and orange striped caterpillars feed upon the leaves late in summer. Spray with lead arsenate.

Fungi.

White Heart Rot—Forms on trunks shelf-fungi, often somewhat hoof-shaped, eventually with dark, creased and cracked, upper surface and rusty-brown, porous, fruiting, lower surface. Gains entrance through wounded and dead branches; causes white rot of heart wood and slow death of sapwood and bark. Break off and burn fruiting bodies; if feasible cut out diseased bark and sapwood, and dig out dead heartwood and fill cavity with cement. Occurs in other deciduous trees. Bull. 222, p. 446.

OATS.

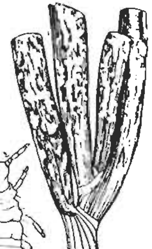
Insects.

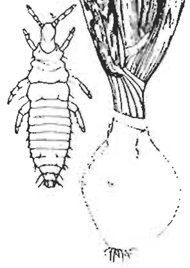
Army Worm—See Grass.

Fungi.

Black Stem Rust—Forms, chiefly on leaf sheaths and stems, first the II stage as reddish pustules and later the III stage as elongated black outbreaks. Also occurs on wheat, rye, and other grasses as different strains. The I stage appears in spring on barberry leaves as cluster-cups but the fungus can skip this stage. Quite serious in regions where grain is grown extensively, and difficult to control. This and several related species are becoming more important here as more grain of various kinds is grown. Cut out barberries in vicinity of fields.

Smut—Destroys the grain, turning it into a black dusty mass of spores. Seed treatment will prevent this smut. Either soak the seed 8 to 10 minutes in water at 132.5° F., or sprinkle thoroughly with formalin (formula A), stirring the grain so that it is thoroughly wet, and leave in piles for several hours before drying out. A less cumbersome treatment coming into general use is that given under formula B. Buy seed from smut-free fields.





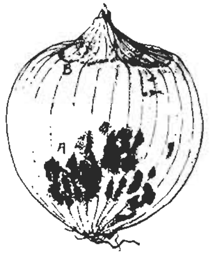
ONION.

Insects.

Thrips or **"White Blast"**—Very small insects which feed upon the surface of the leaves, giving the field a whitish appearance. Burn all tops and refuse; burn over the grass land around the field to kill over-wintering insects. Spray with nicotine solution and soap, or kerosene emulsion. Repts. 1903, p. 266; 1913, p. 233.

Maggot—Infests the bulb of the young plant. Practice rotation of crops. Spray plants here and there over the field with sweetened lead arsenate to kill the adult flies. Rept. 1911, p. 286.

Fungi, etc.



Anthracnose (**Black Spot**)—Produces black circular spots on the bulbs, usually on white varieties after storing in the barn. Store onions as dry as possible and keep barn dry and cool. Avoid piling too deeply in bins. Possibly air-slaked lime mixed with sulphur scattered over them at time of storing may prove beneficial. See Stem Rot for treatment with formalin fumes. Fig. (A). Rept. 1889, p. 163.

Smut—Forms black dusty outbreaks on various parts of plants raised from seed; especially injurious to the very young seedlings. This fungus becomes established in the soil, hence infected land should be avoided or used only for transplanted onions. If, however, it is seeded, apply with the seed in drills per acre, 100 lbs. sulphur thoroughly mixed with 50 lbs. air-slaked lime. Formalin (1 lb. or 1 pt. to 12 or 15 gallons water) thoroughly sprinkled over the seed, before covered, by drip attachment to the seeder, is an even more desirable remedy. Repts. 1889, p. 129; 1895, p. 176.

Stem Rot—Causes rotting of bulbs at stem end, where they become soft and shrunken, sometimes showing beneath the layers a dense olive-brown growth of mold. This fungus in a moist season occurs on various parts of the plant in

the field (possibly responsible for "blast" of seed onions), but does not usually appear as a serious trouble with the bulbs until some time after they have been placed in the barn. Treat as for black spot. Late field spraying with Bordeaux shortly before pulling and again while lying in the field, combined with treatment by formalin fumes (See Fungicides) after storing, has given some indications of benefit. See Fig. (B) under anthracnose. Repts. 1903, p. 334; 1904, p. 321.

PALMS.

Insects.

Scales—Several kinds of white and brown scales infest the species of palms grown in greenhouses. Apply nicotine solution or soap and water as a spray or as a dip.

Fungi.

Anthracnose—Frequently causes leaves to die at tip. Fungus inconspicuous, may show as small black imbedded specks oozing pinkish masses of spores. Avoid infected stock or isolate it; pick off and burn worst infected leaves; keep leaves dry and house well ventilated. Rept. 1913, p. 18.

PARSLEY-PARSNIP.

Insects.

Celery Caterpillar—On both hosts. See Celery.

Parsley Stalk Weevil—Larva tunnels in crown of plant. No remedy other than to destroy infested plants. Rept. 1913, p. 252.

Fungi.

Drop—On Parsley. See Lettuce.

Soft Rot—On Parsnip. See Salsify.

PEA.

Insects.

Green Pea Aphid—Attacks the plants early in June and sucks the sap from the leaves and stems, often causing great injury. Early peas may mature a crop before aphids injure them. Spray vines with nicotine solution and soap. Brush the vines just before cultivating. Repts. 1899, p. 240; 1913, p. 235.

Pea Weevil—The adult lays eggs in the pods in the field and the larvae develop in the seed, emerging through round holes. Fumigate with carbon disulphide. Bull. 195, p. 5.

Fungi.

Leaf Spot and **Powdery Mildew**—The former shows as roundish spots on both pods and leaves; the latter, as a mealy or cobweb-like coating on same. Neither seems to be sufficiently injurious here to warrant the expense of spraying.

Root-Rot—Kills tops of roots and base of vines, causing parts above to turn yellow, wilt and die prematurely. Caused by various soil fungi of which the downy mildew was especially prominent in 1919. Practice rotation, use *well-rotted* manure and give frequent cultivation in wet years to hasten the drying of the top soil. Bull. 222, p. 450.

PEACH.

Insects.

Peach Saw-Fly—Larvae feed upon leaves in June and July. Spray with lead arsenate. Rept. 1907, p. 285.

Peach Borer—Larva tunnels in the base of the trunk. Dig out in late fall and early spring. Paint base of trunk with lead arsenate and lime-sulphur. Remove top soil and sprinkle powdered paradichlorobenzene around the trunk, using about 1 ounce per tree and cover with soil. Rept. 1909, p. 359.

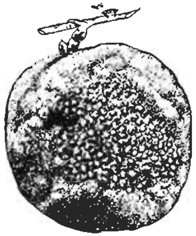
Fruit Bark-Beetle or **Shot-Hole Borer**—Makes minute tunnels under the bark of branches and trunk. Burn infested trees and keep others thrifty. Rept. 1896, p. 240.

Plum Curculio—See Plum.

San José Scale—Minute scale insects, with circular shell, which suck the sap from twigs, fruit and leaves. On fruit a red spot surrounds each insect. Spray dormant trees with lime-sulphur. Bull. 165; Rept. 1901, p. 240.

Black and **Green Aphids**—Suck the sap from the leaves and shoots. Spray with nicotine solution.

Fungi, etc.

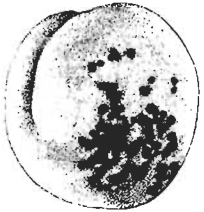


Brown Rot—Occurs on the young twigs, etc., but causes most serious injury to the fruit, rotting it about the time of its maturity. The rotten areas usually become covered with numerous pustules of dusty brownish spores; eventually the diseased fruits form hard mummies. These carry the fungus over the winter, and if half buried in the soil develop in early spring the mature stage, which causes infection of the blossoms, etc. Certain early varieties, like the Champion, are especially subject to rot. Spraying these apparently pays in this state. See general directions for treatment. This fungus occurs on plums and cherries and less commonly on pears and apples. Repts. 1909-10, pp. 607, 612; 1911, pp. 374, 391.

Crown Gall—See Plum.

Leaf Curl—Causes young leaves to become irregularly curled and swollen and finally to drop off; rarely on fruit. In April as soon as buds begin to swell, spray the trees thoroughly with commercial lime-sulphur 1:9. If more convenient this may be done in late fall and is claimed to be just as effective. Same treatment takes care of San José scale. Repts. 1909-10, pp. 608, 612; 1911, p. 374; 1914, p. 19.

Powdery Mildew—Forms a grayish felt on young twigs and leaves. Prune off infected twigs. Give winter treatment as for leaf curl, and, if necessary, summer treatment as for scab and brown rot.



Scab—Produces roundish, olive-black spots on the fruit, discolored areas on the young twigs, and rarely "shot-holes" in the foliage. Two treatments with self-boiled lime-sulphur or atomic sulphur upon the fruit after setting and when half grown (about the middle of May and June) will control this trouble. Repts. 1896, p. 269; 1909-10, pp. 608, 614; 1911, pp. 375, 391.

Spray Injury—Is more likely to occur than with same treatment on apple, *q. v.* Avoid Bordeaux altogether. See (3) under general treatment following. Repts. 1900, p. 219; 1911, p. 372.

Winter Injury—Shows in various ways. In severe winters, especially when the ground is bare, the roots may be killed without injury to parts above the ground. In spring such trees put forth a scanty sickly foliage that soon drops. Often the injury occurs in the form of a "collar girdle" in the bark at the base of the tree. Sometimes it occurs above ground in the wood (shown by

its blacker color), with or without injury to the bark. When the bark is not injured, severe pruning in spring will often save the trees. Nursery trees can sometimes be cut back to the snow line, below the injury, and an entirely new healthy trunk started. Avoid late applications of nitrogenous fertilizers and cultivation after middle of July. Mulch base of young trees in late fall with earth. Secure good drainage. See Apple. Repts. 1903, p. 341; 1908, p. 872.

Yellows—Causes premature ripening and red spotting of fruit with yellowish curled leaves, and in time spindling sprout growths in bunches on the trunk. This is claimed to be a contagious disease, but it is apparently physiological in nature. Little peach in this state is scarcely to be distinguished from yellows, showing chiefly in the small backward fruit. Root out and burn all trees as soon as found; prevent winter injury; be careful in selecting stock for planting. Nurserymen should use especial care in selecting their stock for budding. Repts. 1893, p. 92; 1908, p. 872.

General Treatment for Peach Orchards.

(1) Spraying of peaches while dormant is of value only in checking San José scale, mites and leaf curl. One application of commercial lime-sulphur, 1-9, either in late fall or early spring, will take care of all of these troubles at the same time. If the scale and the leaf curl are unusually prevalent, both applications will prove of value in controlling them.

(2) For the prevention of scab and rot of peaches, it is as a rule desirable to give three sprayings, as follows: 1st, shortly after the blossoms have fallen (May 15th to May 25th); 2nd, about three or four weeks later (June 5th to June 15th); and 3d, about one month later (July 5th to July 15th). If only two sprayings can be given, omit the first if spraying only for rot, and the last if spraying only for scab.

(3) On the whole, self-boiled lime-sulphur of the 8-8-50 formula or atomic sulphur seem to be the safest and most reliable peach sprays. Fair results have been obtained with some of the commercial lime-sulphurs, and they are much more easily handled. There is, however, some danger of spray injury, especially with certain brands. If commercial lime-sulphur is used, a strength of not greater than 1-150, without poison, is recommended.

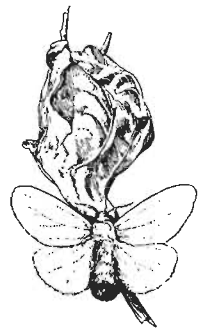
(4) As lead arsenate has done little to prevent curculio injury, and as it seems to increase the danger of spray injury, we advise leaving it out unless there is considerable danger from the sawfly, when it can be added in the second spraying the same as for apples.

PEAR.

Insects, etc.

Pear or **Cherry Slug**—See Cherry.

Codling-Moth—See Apple.



Brown-Tail Moth—Occurs in the United States only in eastern New England. Brown hairy caterpillars feed on leaves, and make winter nests on twigs, maturing about the middle of June. Cut and burn winter nests. Spray foliage as soon as blossoms fall, and also in August, with lead arsenate. Rept. 1910, p. 683; Bull. 182.

Fall Web-Worm—Makes nests on ends of branches of many kinds of trees in late summer, the brown, hairy caterpillars feeding inside the nests. Clip off and burn nests when small. Spray with lead arsenate. Repts. 1901, p. 270; 1917, p. 319.

San José Scale—See Peach.

Pear Psylla—Small jumping plant lice suck sap from leaves and twigs, causing leaves to fall in midsummer. Spray with lime

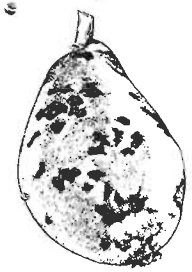
sulphur in spring just before buds open. Spray infested trees with nicotine solution and soap in July. Rept. 1903, p. 262.

Pear Thrips—A minute insect which feeds upon the unopened fruit buds destroying them so that fruit does not set. Spray with nicotine solution and soap just as buds open, and again after blossoms fall.

False Tarnished Plant Bug—Punctures developing fruit causing it to be irregular and knotty. Spray with nicotine solution and soap.

Leaf Blister Mite—Attacks unfolding leaves of apple and pear; forms galls or blisters which become red and later brown. Causes many leaves to fall in July. Spray dormant trees with lime-sulphur in late fall or in spring. Rept. 1910, p. 700.

Fungi, etc.



Scab—Forms olive-black scabby spots on fruit and leaves, often causing the former to become distorted and cracked. The fungus lives over winter on the twigs. Certain varieties are not much injured, others, like Flemish Beauty, are very susceptible. Spray with Bordeaux on unfolding leaves before blossoms open, again after petals fall, and give the third spraying about two weeks later, using weak Bordeaux in last two treatments. Repts. 1894, p. 135; 1904, p. 323; 1911, p. 396.

Blight—Kills young twigs, the leaves suddenly turning black; also produces sunken dead areas on trunks. This is a bacterial disease chiefly spread by bees during blossoming time, or by sucking insects. Winter-prune all diseased branches, cutting off several inches below the diseased area. Cut out cankered areas and swab with disinfectant, paint exposed wood when dry. Several times after blossoming remove all young dead twigs. Use knife sterilized from time to time by wiping with a cloth saturated with carbolic acid or with corrosive sublimate (1-1000). This disease occurs also on apple and quince. Rept. 1894, p. 113.

Leaf Blight—See Quince.

PEONY.

Insects.

Rose Chafer—Adult beetles feed upon blossoms of white varieties. See Grape.

PHLOX.

Insects.

Red Spider—Injures leaves causing them to turn yellow. Clean culture. Spray clear water with force from hose, and in seve infestations, with kerosene emulsion, or with nicotine solution a soap.

Fungi.

Powdery Mildew—Covers more or less completely leaves ar young stems with grayish coating within which are finally imbedde numerous, small, blackish fruiting-bodies. Give several sprayin with commercial lime-sulphur, starting before mildew gains muc headway.

PINE.

Insects.

Sawflies—Larvae of several native and imported species fee upon the leaves. Spray with lead arsenate. Rept. 1917, p. 273.

White Pine Weevil—Adult snout beetle lays eggs on leader i May and grubs feed and develop in it, causing it to wilt and di in midsummer. Leaders of ornamental trees may be protecte by spraying them with lead arsenate or lime-sulphur. Jarrin the adults into a net once a week during month of May, serve to greatly reduce the damage. Infested leaders should be cu and destroyed. Repts. 1911, p. 307; 1919, p. 144.

Pine Leaf Scale—Whitish pear-shaped shells on leaves; sma trees sometimes killed. Spray with nicotine solution or kerosen—

...week in June. Bull. 151; Rept. 1905, p. 240.

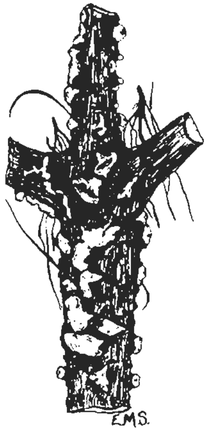
Pine Bark Aphid—White cottony or woolly objects on bark and sometimes on leaves, sucking out the sap. Spray with kerosene emulsion. Repts. 1911, p. 343; 1919, p. 155.

Fungi, etc.

Blight (so-called)—Stunts the leaves and kills their tips inward, often suddenly, so that the tissues for a greater or less distance are reddish-brown. This is a physiological disease; not contagious; due to adverse weather conditions. Chief among these are severe winters, killing the leaves directly or indirectly through injury to roots; warm days, in late winter or early spring when ground is frozen, causing transpiration of water from the leaves that cannot be replaced; very late spring frosts, killing tips of new leaves; sudden changes, in summer from moist or muggy weather to bright sunshine resulting in excessive transpiration and injury; very dry summers. No effective remedy. Rept. 1907, p. 353.

Dampening Off—Caused here chiefly by Rhizoctonia fungus rotting base of the stem, the seedling falling over. Sometimes it creeps up the stem invading the base of the leaves which wither. Certain conifers are more subject to attack then others. Avoid unnecessary watering; provide good ventilation; infected soil often can be helped by treatment with formalin before seeding (see Fungicides, formalin D); spraying with Bordeaux is effective in some cases. Repts. 1912, p. 348; 1915, p. 450.

Stem Rusts—Form on the swollen stems temporary, but conspicuous, white, blisterlike spore cups filled with a dusty orange-colored spore mass. The white pine blister rust, an imported species, spreads to the gooseberries and currants, and forms other less conspicuous leaf stages on these (*q. v.*). A very similar native species on two and three needle pines spreads to the leaves of the sweet fern. In either case infected pines should be destroyed, and watch kept of the alternate hosts, if they occur in the neighborhood. Seed beds should never be made in the vicinity of the alternate hosts, as infection takes place easily in the young pine seedlings. Spray beds with Bordeaux if liable to infection. In white pine plantations pull out all currants and gooseberries including those in the immediate neighborhood (500 feet). Send any suspicious white pines or their alternate hosts to this Station for examination. Rept. 1912, p. 347 Bull. 214, p. 428.

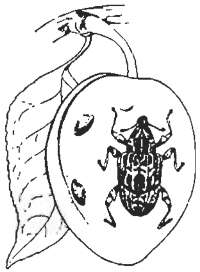


PLUM.

Insects.

Plum Aphids—Suck sap from leaves. Spray with kerosene emulsion, nicotine solution and soap, or with soap and water.

San José Scale—See Peach.



Plum Curculio—Grub infests the growing fruit, causing it to fall. Jar the trees each morning for six weeks after blooming and catch the beetles on sheets and destroy them. Spraying with lead arsenate during the same period is also advised. Rept. 1910 p. 609.

Fruit Bark-Beetle or **Shot-Hole Borer**—See Peach.

Fungi.

Black Knot—See Cherry.

Brown Rot—Thin fruit so it does not touch. Gather and destroy all mummies after harvest. Rather difficult to control

by spraying, as spray does not readily adhere to the smooth fruit. First treatment with self-boiled lime-sulphur, should be made on half grown fruit, others at intervals of two weeks, and the last one 10-14 days before picking. See Peach.

Crown Gall— Forms hard roundish knots one-half inch or more in diameter, near crown or on roots, less frequently on lower part of trunk. Do not plant infected trees. Remove knots when found and paint over cut surface. This is said to be very troublesome in some states, but here, as yet, little damage has resulted from it except possibly on blackberries and imported roses. It also occurs on peach, apple, raspberry, and various ornamental plants.

POPLAR.

Insects.

Poplar Tent-maker—Larvae feed on leaves and fold them together near ends of branches, forming nests. Spray with lead arsenate. Rept. 1911, p. 310.

Spiny Elm Caterpillar—See Elm.

Tussock Moths—See Apple, Hickory and Horse Chestnut.

Poplar Borer—Larvae make large galleries in wood of trunk. Dig out, or inject carbon disulphide into the burrow and close the opening. Rept. 1907, p. 336.

Poplar and **Willow Curculio**—Larva tunnels in smaller trunk and branches. Destroy badly infested trees. Cut out borers; inject carbon disulphide. Rept. 1907. p. 335.

Oyster-Shell Scale—See Apple.

Fungi.

European Canker—Forms sunken dead areas of varying extent in the bark. Importation from Europe; showing here most commonly on Lombardy and white poplars. If trees are badly injured cut down and burn; otherwise cut out diseased areas going into the healthy bark, scraping and painting over exposed wood if surface is extended. Bull. 222, p. 461.

Rusts—Show on leaves as minute, powdery, yellow-orange pustules in II stage, and as slightly elevated reddish blisters in III stage. Have I stage, for different species, on larch and hemlock. Avoid planting near these hosts in nursery; rake up and burn infected leaves in the fall. Rept. 1915, p. 440.

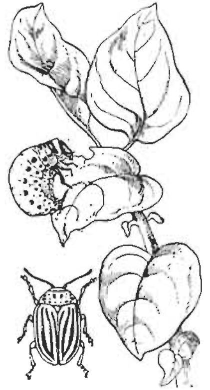
POPPY.

Insects.

Aphids—Black aphids suck sap from stems and leaves. Spray with nicotine solution and soap.

POTATO.

Insects.



Flea Beetle—Small black jumping beetles cut holes through the leaves. Spray heavily both upper and under leaf surfaces with lead arsenate or calcium arsenate. Bull. 208 p. 103; Rept. 1906, p. 271.

Colorado Beetle—Adults and larvae devour the leaves. Spray with lead arsenate as soon as injury is apparent. May be used in Bordeaux mixture. Bull. 208, p. 106; Rept. 1911, p. 311.

Three Lined Potato Beetle—Larvae feed upon the leaves and carry their black excrement on their backs. Spray with lead arsenate. Bull. 208, p. 109.

Stalk Borer—Larva tunnels inside the stalk. Burn infested vines. See Dahlia. Bull. 208, p. 111.

Potato Aphid—Green and pink aphids appearing in large numbers suck the sap from shoots and stems, causing much damage in 1917. Spray with soap and nicotine solution. Bull. 208, p. 115.

Fungi, etc.

Black Leg—Causes a black rot of stem below ground; plants more or less stunted with yellowish curled foliage; occasionally rots tubers. Usually only scattered plants appear in the field, not spreading to the healthy. Soaking seed in formalin as for scab said to be helpful. Rept. 1914, p. 21.

Blight or **Downy Mildew**—Causes a sudden blackening of the leaves, and often death of vines, from July to September in moist seasons; usually shows a slight whitish growth of fungus on the under side of the leaves; rots tubers. Spray with Bordeaux before the trouble appears, about July 1st, and keep vines well covered to the end of the season. Three to five sprayings by hand or five to seven by power sprayer are necessary. After last cultivation thoroughly ridge up the rows to help keep the spores from washing down to the tubers. Early varieties often escape blight by maturing before its appearance. Repts. 1904, p. 363; 1905, p. 304; 1909-10, p. 739; 1915, p. 470; 1916, p. 355; Bull. 214, p. 411.

Mosiac—Shows as a more or less conspicuous yellow-green mottling of the leaves. A physiological disease not well understood. New here but apparently not so injurious as in some other places. Do not save tubers for planting from hills showing this trouble. Bull. 222, p. 464.

Scab—Produces the common scabby appearance on surface of tubers. Soak uncut seed-tubers one hour in formalin (formula C). Formalin fumes (see Less-Used Fungicides) are often used when large quantities are treated. Care in filling space sufficiently, however, is necessary to avoid injury by "pitting" from absorption of fumes. Corrosive sublimate is again recommended by some investigators especially where the black scurf (Rhizoctonia fungus) also occurs on the tubers, as this treatment seems more effective against the latter. Hot corrosive sublimate or formalin for short periods has also been recommended for potato tuber diseases. Avoid planting on infected land, by systematic rotation. The use of lime, wood ashes, and various barnyard manures will increase the amount of scab. The same trouble occurs on beets and turnips. Fig. (B). Repts. 1890, p. 81; 1891, p. 153; 1894, p. 118; 1895, p. 166; 1896, p. 246; 1909-10, p. 744.

Tip Burn—Causes leaves to die at tip and margins and roll up; often mistaken for true blight. This is a physiological trouble due to drought or sudden change from moist to very hot bright weather. Cultivate thoroughly and often to conserve moisture. Spray with Bordeaux as for blight, as this often helps to increase yield by lengthening life of leaves. Rept. 1909-10, p. 742.

PRIVET.

Insects.

Privet Leaf Folder—Larvae web together terminal leaves and feed inside. Clip off and destroy infested shoots. Spray with lead arsenate. Rept. 1913, p. 223.

Privet or Lilac Borer—See Lilac.

Anthracnose—Forms small cankers on stems causing parts above to wilt and die. Usually found in nurseries on recently transplanted European privet. Prune off and burn infected branches; if bad spray with Bordeaux. Rept. 1914, p. 22.

Winter Injury—Shows in spring by stems usually being killed down to base or snow line. Cut off dead stems below injury and a vigorous new growth will result if roots are not injured. Rept. 1904, p. 326.

QUINCE.

Insects.

Round-Headed Borer—See Apple.

Quince Curculio—Grubs infest growing fruit and adults feed upon it causing it to be knotty. Jar the trees same as for plum curculio. Spray with lead arsenate.

Aphid—See Apple.

Fungi, etc.

Black Rot—Rots the fruit, often beginning at the blossom end; also kills twigs and branches. In the fall or spring cut off and burn all dead branches. Give three sprayings, as for leaf blight, with Bordeaux mixture.

Blight—See Pear.

Leaf Blight—Forms rounded, often confluent, reddish-brown spots with central black dots on leaves and fruit, the former often shedding prematurely and the latter cracking irregularly. Spray with Bordeaux just before blossoms open, again soon after they fall, and follow with 1 or 2 additional treatments at intervals of about 2 weeks, according to the weather. This fungus also occurs on pear. Repts. 1890, p. 99; 1891, p. 150.

Rust—Produces small clustered cups, with fringed borders and filled with orange spores, on fruit, young twigs and less frequently on leaves. Cut off and burn infected twigs and fruit. Look infected cedars in neighborhood. See Apple Rust.

RADISH.

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Insects.

Maggot—See Cabbage.

Aphid—See Turnip.

Fungi.

Club Root—See Cabbage.

RASPBERRY.

Insects.

Raspberry Sawfly—Larvae devour leaves. Spray with lead arsenate or hellebore. Rept. 1918, p. 329.

Cane Borer—Larva tunnels inside the canes. Cut and burn infested canes.

Raspberry Fruit-Worm—Brown beetles feed upon buds, leaves and blossoms, and white larvae adhere to berries at picking time. Spray with lead arsenate when beetles first appear.

Fungi, etc.

Anthracnose—Shows as more or less confluent whitish spots, with purplish borders, on the stems. In spring, before buds swell, cut out and burn all badly infected canes and then spray with Resin-Bordeaux. If disease is very bad, spray again when young shoots are about six inches high, and repeat in 10 to 14 days. Aim chiefly to cover the young shoots with the spray. After fruit is gathered, again remove any badly infected canes. Cultivate ground thoroughly to promote vigorous growth of canes. Rept. 1899, p. 274.

Crown Gall—See Blackberry.

Rust—See Bl...

above to wilt. In the old canes and near the pruned ends, the fungus often develops a brownish coating of spores around each small imbedded fruiting receptacle. The green berries often dry up without apparent cause, due to inoculation by insects. Spraying has not proved very satisfactory. Old and diseased canes should be removed and burned after the fruiting season and again early in spring. Rept. 1906, p. 321.

Yellows—Causes foliage to become more or less crinkled, and mottled with a sickly yellowish color. Plants gradually become worthless. Spraying does not seem to help this trouble, which apparently is of similar nature to peach yellows. Dig out plants with the yellows. Propagate only from perfectly healthy ones.

RHODODENDRON.

Insects.

Rhododendron Lace Bug—This bug sucks the sap from the under side of the leaves, which are usually colored brown by its excrement. Spray with nicotine solution or kerosene emulsion. Rept. 1910, p. 708.

Fungi, etc.

Leaf Scorch—Shows as dead marginal areas of varying width usually appearing suddenly. Plant in shade; keep ground mulched; water if necessary in dry weather by soaking ground beneath mulch. Rept. 1914, p. 23.

ROSE.

Insects.

Rose Slug—Eats away the green portion of the leaves. Spray with hellebore, lead arsenate or nicotine solution.

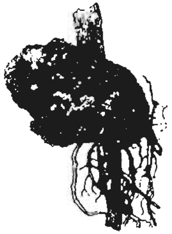
Rose Midge—Larvae distort young leaves and flower buds in greenhouses. Apply tobacco dust to the soil and fumigate nightly with tobacco stems or nicotine paper.

Rose Chafer—See Grape.

Spray with nicotine solution and soap.

Rose Scale—Whitish circular shells on the stems contain insects which suck the sap. Cut and burn worst infested canes. Spray with nicotine solution and soap. Bull. 151, p. 11; Rept. 1905, p. 241.

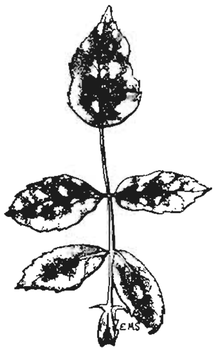
Aphid or **Green Fly**—Sucks sap from the leaves and stems. Spray with nicotine solution.



Fungi, etc.

Crown Gall—Occurs very frequently on rose roots, especially those of Manetti stock. There is some question how much infected plants eventually suffer. See Plum. Rept. 1911-12, p. 355.

Leaf Blotch—Forms large purple-black blotches on leaflets, which often turn yellow and fall off. For greenhouse treatment paint hot water pipes with mixture of sulphur and oil. Potassium sulphide or commercial lime and sulphur can be sprayed on the foliage. Spraying out of doors can be done with Bordeaux, if there is no objection to the sediment on leaves. Rept. 1903, p. 355.



Mildew—Develops a white powdery or cobweb-like growth on the young leaves, which become more or less distorted and fall off; occasionally blasts blossoms of certain varieties. Tea roses especially susceptible. Treat same as for leaf blotch; or dust flowers of sulphur over the leaves; be careful in airing greenhouses. Rept. 1903, p. 356. Bull. 222, p. 474.

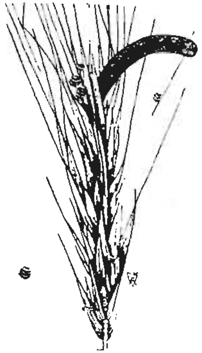
RUTABAGA, See TURNIP.

RYE.

Insects.

Army Worm—See Grass.

Wheat Midge—See Wheat.



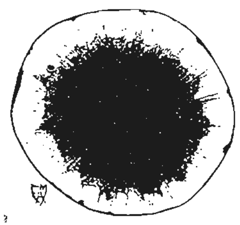
Fungi.

Ergot—Forms conspicuous, elongated, purplish sclerotia, usually one in the spike, most common in volunteer rye, but occasionally in cultivated fields. Keep these sclerotia out of cattle feed as they may cause abortion and other troubles.

Powdery Mildew—Shows as a thick grayish felt on the leaves with fruiting bodies as blackish embedded specks. Causes premature death of leaves; often associated with rust. No practical remedy. Rept. 1909-10, p. 735.

SALSIFY.

Fungi, etc.



Soft Rot—Forms a soft rot of the interior tissues of the roots running down from the crown and turning them a darker color. Usually occurs after storage. Same bacteria cause soft rots in a variety of plants. Avoid contaminated manure and too much rotting humus in the fields; store under dry cool conditions, allowing sufficient ventilation. Rept. 1914, p. 25.

SNAPDRAGON.

Insects, etc.

Leaf Mites—Cause leaves to curl and plants do not blossom. Spray with nicotine solution and soap, same as for Cyclamen. Rept. 1914, p. 176.

Root-Knot Eelworm—Causes irregular swellings on the roots where the eelworms are present, with resulting premature decay and sickly appearance of parts above ground. Worst in greenhouses and hot-beds as this far north the nematodes are killed in unprotected ground over winter. Attacks roots of a great variety of cultivated plants. Purchase only healthy plants; change infected soil if possible, dry out thoroughly in summer, leave out doors over winter or sterilize with steam; avoid contamination of soil with infected refuse. Rept. 1915, p. 452.

Fungi.

Anthracnose—Shows as whitish spots with distinct purplish border on leaves and stems; spots often running together. Select seed and cuttings only from healthy stock; pick off and burn infected leaves. Spray with Bordeaux.

Rust—Forms reddish-brown, roundish pustules chiefly on under side of leaves causing tissues above to become yellow spotted. Appearing in greenhouses and causing more or less injury according to prevalence. Treat as for anthracnose. Rept. 1915, p. 443.

SNOWBALL.

Insects.

Aphids—Suck sap from the leaves causing them to curl. Use nicotine solution and soap as a spray or dip.

SOY BEAN.

Fungi, etc.

Bacterial Leaf Spot—Forms small, dark, reddish-brown angular spots frequently merging into larger areas. Certain varieties appear more susceptible than others, Ito San being one of the

worst. Grow least susceptible varieties and if possible purchase seed from uninfected fields.

Crinkling Chlorosis—Shows as crinkling or yellowish-green mottling of leaves, or both together. Plants less vigorous than normal ones. Hollybrook variety apt to show trouble most. Treatment same as in preceding.

SPINACH.

Insects.

Spinach or **Beet Leaf-Miner**—See Beet.

SPIRAEA.

sects.

Aphids—Suck sap from the new shoots. Use nicotine solution id soap as a spray or dip.

SPRUCE.

sects.

Spruce Gall Aphid—Forms galls at the base of the new growth ı Norway and other spruces. Spray in the late fall or early spring with nicotine solution and soap or with kerosene emulsion. Rept. 1906, p. 302.

Spruce Bud Moth—Larva feeds on leaves of terminal shoots of the branches causing much damage. Spray with lead arsenate. Rept. 1912, p. 291.

SQUASH-PUMPKIN.

Insects.

Squash Lady-Beetle—Both adults and larvae devour the leaves. Spray with lead arsenate. Bull. 181, p. 11; 216, p. 42; Rept. 1908, p. 810.

Striped Cucumber Beetle—See Cucumber.

Squash Bug or **Stink Bug**—A brown bug three-fourths of an inch in length sucks the sap from the under side of the leaves, causing them to wilt and die. Spray with kerosene emulsion to kill the young. The old bugs may be trapped by placing boards or shingles on the ground, which should be visited each morning and the bugs killed. Bull. 216, p. 44; Rept. 1908, p. 811.

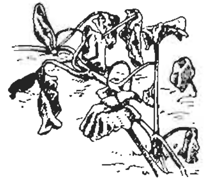
Squash-Vine Borer—Larva tunnels in the base of the stem, causing decay. Cut slits lengthwise in the stem and kill borers. Cover the joints of the vine with earth so that new shoots may be formed to support the plant. Grow a few early plants for traps, and destroy them. The main crop should be planted rather late. Bull. 216, p. 39; Rept. 1908, p. 806.

Fungi.

Anthracnose—See Watermelon.

Storage Rots—Caused by various fungi that are best held in check by storage under conditions with minimum of heat and moisture.

Wilts—Cause leaves of the plants to wilt and then dry up, sometimes all of the vine thus suddenly dying. If a cross section of the stem shows a slight milky and sticky exudation, it is caused by bacteria that clog up the water ducts. Fungi in the ducts or insects at the roots may cause similar trouble. Heavy manuring often develops these troubles. Spraying is of little value except as it may keep off insects which inoculate the plants with the



bacteria. Use enough seed to allow for loss by wilt and pull up and destroy all the wilted vines as they appear. Rept. 1903, p. 359.

STRAWBERRY.

Insects.

Strawberry Sawflies—Larvae devour leaves. Spray with lead arsenate or hellebore.

Strawberry Weevil—Small snout beetles; females cut off blossom buds of staminate varieties when ovipositing. Plant pistillate varieties in part.[s] Dust heavily with lead arsenate and sulphur (1–5.)

Strawberry Crown Borer—Grub tunnels and feeds in crown of plant. Practice crop rotation. Burn over infested field in fall.

Strawberry Flea Beetle—Adults eat holes through the leaves. Spray with lead arsenate.

Strawberry Leaf Roller—Larva rolls leaf and feeds inside. Spray with lead arsenate. Burn fields and plow abandoned fields as soon as crop is harvested.

Strawberry Root Aphid—Sucks sap from leaves and roots, killing plants. Set clean plants on land not infested. Spray with nicotine solution and soap.

Strawberry White Fly—Sucks sap from leaves. Underspray with nicotine solution and soap.

White Grubs—See Grass.

Fungi.

Leaf Spot and **Blotch**—Cause conspicuous discolored spots, the former usually with whitish centers and purplish borders, and the latter with dark centers. Glen Mary sometimes severely injured by latter fungus. Renew the beds frequently. In the late fall or early spring cut off leaves with mower, add a little straw where necessary, and burn over beds. Spray with Bordeaux two or three times before blossoming, beginning last of April and repeating weekly, and once after blossoming is over. Repts. 1903, p. 360; 1914, p. 5.

Powdery Mildew—Covers leaves (more frequently on under, but more conspicuously, when present, on upper surface) with cobweb-like growth, often causing them to become stiff and curled inward. When necessary, this can probably be controlled with Bordeaux if sprayed before abundant. Rept. 1905, p. 276.

SWEET PEA.

Insects.

Aphids—See Pea.

White Fly—See Tomato.

Fungi.

Dampening Off—Rots off stem just below ground causing vines to turn yellow and finally die. Plant in well drained soil; place well rotted manure deep in ground below the seed; avoid excessive watering; spray base of vines and ground with Bordeaux; change beds if appearing yearly. Rept. 1907, p. 359.

SWEET POTATO.

Insects.

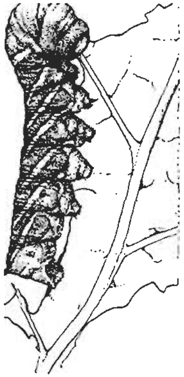
Tortoise-Shell Beetles—Feed upon leaves. Spray with lead arsenate. Bull. 208, p. 110.

SYCAMORE.

Fungi.

Anthracnose—Kills young leaves in the spring; causes dead areas of irregular shape in tissues of older ones often following veins. If thought advisable to spray, use Bordeaux on the leaves as soon as showing and repeat when half grown.

Insects.

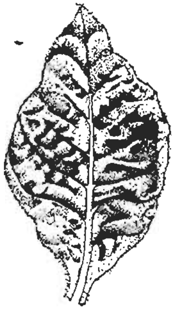


Tobacco or **Tomato Horn-Worms**—Large green caterpillars with horn on the tail devour the leaves. Practice hand picking or spray the plants with lead arsenate. Rept. 1906, p. 269.

Flea Beetle—Adults eat holes through the leaves. Spray upper and under surface heavily with lead arsenate. Bull. 208, p. 103; Rept. 1906, p. 271.

Cut Worms—See Tomato.

Fungi, etc.

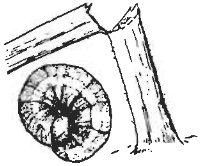


Calico—Causes the leaves to become irregularly mottled with a lighter green color and makes a very inferior tobacco. Frequently infected leaves finally show numerous, irregular, often merging, brown spots known as "rust." While calico is a physiological disease, due to injurious enzymes, it can be communicated to a healthy plant through contact with a very small amount of juice from a diseased plant. Care, therefore, is necessary after handling diseased plants in touching healthy ones. Never use tobacco water or tobacco stems on the seed beds. If calico shows in a seed bed, pull up all suspicious plants and those surrounding them. If troubled year after year, sterilize the seed beds or change them, and never make them on land used for tobacco the year before. When transplanting, wash the hands occasionally with soap and water. Repts. 1898, p. 242; 1899, p. 252; 1914, p. 357; Bull. 166, p. 10.

lings close to the ground, and cause them to fall over. Keep air of beds as dry as consistent with good growth by care in watering and ventilating. If trouble starts in spots, take out all infected plants and refuse there.

Root Rot—Shows in seed beds by dwarfed "rosette" plants whose roots have been largely rotted off. Occasionally it does more or less damage in fields, especially in alkaline or water soaked soils; a short rotation is advisable in such cases. Sterilize seed beds with steam or treat with formalin (formula D). Repts. 1906, p. 342; 1907, p. 363.

Wild Fire—Shows first in lower leaves as small, roundish, yellow spots. In time these grow larger, turn darker, and irregular dead areas appear more or less prominently. This disease is caused by bacteria, is favored by wet weather and is apparently new to the state. It is carried on the seed and later may be readily transferred from infected places in the field by certain insects and the wind. Care should be used to select seed only from disease-free fields and sow this seed in sterilized seed beds. Where doubtful seed is used this should be soaked for 15 minutes in 1 pint of water to which is added 1 oz. of formalin, stirring the seed during the treatment. Drain off the liquid, wash seed in pure water several times and dry before storing. Old cloth used previously on infected beds should be boiled in water before used again.



TOMATO.

Insects.

Cut Worms—Eat off plant near ground or climb the plant and devour the leaves. Place around field poisoned bait or bran mash containing arsenic. Trap cut worms with small

piece of board. Rept. 1906, p. 264; Bulls. 190, p. 18; 208, p. 112; 216, p. 43.

Tomato or **Tobacco Horn-Worm**—See Tobacco.

Flea Beetle—See Potato or Tobacco.

Potato Aphid—See Potato.

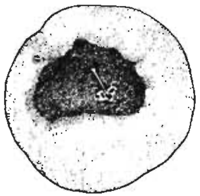
Stalk Borer—See Dahlia.

White Fly—Sucks the sap from under side of leaves. Spray underside of leaves with soap and water. Fumigate greenhouses with hydrocyanic acid gas (1 oz. to 1000 cubic ft.). Bulls. 140; 216, p. 50; Rept. 1902, p. 148.

Fungi, etc.

Mosaic—Rept. 1908, p. 857. See Calico of Tobacco.

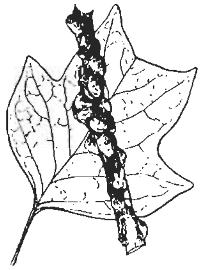
Leaf Spot—Produces on leaves and stems numerous, small, dark spots, often with white centers. Begin spraying with Bordeaux about the middle of July, making 3 or 4 applications at intervals of 10-14 days. This usually develops too late in the season here to cause serious damage.



Point Rot—Causes the green fruit to rot at bloom end, showing a large, firm, dark-brown area. Claimed to be a physiological trouble. Frequently bad in very dry seasons. In greenhouses sub-irrigation is said to prevent it. Spraying, apparently, is of little value. Considerable difference exists in varieties as to susceptibility.

Scab—Occurs most commonly in greenhouses, covering under surface of leaves more or less abundantly with an olive-brown growth which finally kills the tissue above. Spray with Bordeaux, picking ripe fruit before each of the later treatments.

Wilt—Occurs here chiefly in greenhouses; plants turn yellow and slowly wither up; fungus may finally show on dead stem and fruit as pinkish growth. Caused by fungus clogging ducts and cutting off water supply to leaves; in young stage presence shown by blackened bundles where stems are cut across. Change soil if appearing yearly; do not sow seeds from infected plants as they can carry the disease. Spraying of no value. Rept. 1903, p. 366.



TULIP TREE.

Insects.

Tulip Tree Scale—Large brown hemispherical soft scales on bark, sucking the sap, especially on lower branches. Spray with lime-sulphur when trees are dormant. Bull. 151; Repts. 1905, p. 239; 1912, p. 294.

TURNIP-RUTABAGA.

Insects.

Cut Worms—See Tomato.

Cabbage Maggot—See Cabbage.

Turnip Aphid—Green aphids on under side of leaves sucking the sap. Underspray with soap and water or nicotine solution. Rept. 1916, p. 98.

Fungi, etc.

Club Root—See Cabbage.

Soft Rot—Causes an interior soft decay of roots, etc., of a variety of vegetables, such as turnips, salsify, parsnips, carrots, celery. Very wet seasons and imperfect storage conditions are usually the starting point of these troubles. Store under best possible conditions for keeping down heat and moisture. Keep contaminated refuse out of manure pile. Rept. 1914, p. 2[illegible]

Phoma Rot—Appears usually after storage, causing conspicuous, dry, sunken, subcircular, black spots scattered over roots. Fruiting pustules show as black dots. Store roots in cool dry place and not too deeply in the piles. Practice yearly rotation and keep refuse from manure pile. If necessary, use only artificial fertilizers. Rept. 1912, p. 355.

VIOLET.

Insects, etc.

Violet Midge—Larvae in curled edges of new leaves. Fumigate every other night with hydrocyanic acid gas ($\frac{1}{2}$ oz. to 1000 cu. ft.)

Violet Sawfly—Larvae devour leaves. Spray with lead arsenate or hellebore.

Eelworms—Form galls on the roots. Plant in new soil or sterilize the old soil by steam. Add plenty of air-slaked lime to the soil. See Snapdragon.

Fungi.

Spot Disease—Shows as whitish round spots on the leaves. Spray field plants early in fall with Bordeaux. Select only best stock for greenhouse; remove *all* affected leaves before transplanting. When plants become established, spray again with Bordeaux. Be careful about watering plants, and, by proper ventilation and heat during September to November, keep atmosphere of house from ever becoming too moist.

WALNUT.

Insects.

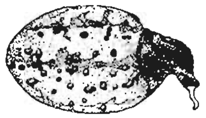
Walnut Caterpillar—Clusters of black caterpillars covered with whitish hairs strip the branches and finally the trees in August. Spray with lead arsenate. Clip off twigs when caterpillars are small, and kill by crushing. Repts. 1914, p. 191; 1917, p. 326.

Walnut Weevil or **Curculio**—Adults feed at base of leaf stems. Larvae tunnel in new shoots and infest the fruit of Persian and Japanese walnuts. Spray with lead arsenate. Rept. 1912, p. 240.

Walnut Bud Moth—Larvae feed upon tender leaves and shoots, webbing them together. Spray with lead arsenate. Rept. 1912, p. 253.

WATERMELON.

Fungi.



Anthracnose—Shows as more or less abundant, dark, sunken spots or areas on the fruit. Also infects leaves in spots. Usually appears here too near end of season to cause sufficient injury to warrant spraying; spray also fails to adhere well to the fruit. Rotation and removal of rotting melons from field may possibly be helpful restrictive measures.

WHEAT.

Insects.

Army Worm—See Grass.

Hessian Fly—Maggots burrow in sheath of a leaf at base of stem, causing the stalks to turn yellow and die. Plant rather late—say about September 1st.

Wheat Midge—The fly lays eggs on the chaff and the maggots feed upon the developing kernels, so that the heads ripen early and produce no grain. Burn stubble before plowing. Plow infested fields deeply in the fall. Rept. 1917, p. 366.

Green Bug or **Aphid**—Green aphids suck the sap from leaves. Destroy in early fall all volunteer wheat and oats. Practice crop rotation.

Fungi.

Black Stem Rust—See Oats.

Leaf Rusts—Form small, dusty, orange-colored outbreaks on leaves, etc., and later darker and firmer mature stage. Several

closely related species on barley, rye, and wheat but quite distinct from the black stem rust. Some varieties are more resistant than others to these various grain rusts. No effective treatment.

Loose Smut—Destroys entire head turning it into a dusty olive-black mass that is dissipated in time. Severe hot water treatment partially effective. See Oats.

Stinking Smut—Fills the apparently scarcely changed seeds with a dusty mass of spores. Spores often found more or less abundantly in middlings and other feeds containing wheat, and their presence in amount indicates poor quality, and may have some connection with complaints of injury to stock fed on these. Use formalin treatment. Rept. 1909-10, p. 736.

WILLOW.

Insects.

Fall Web Worm—See Pear.

Spiny Elm Caterpillar—See Elm.

Poplar Tent-Maker—See Poplar.

Poplar and **Willow Curculio**—See Poplar.

Sawflies—Larvae devour leaves. Spray with lead arsenate.

Aphids—Large reddish aphids congregate on twigs in fall, and suck the sap. Spray with kerosene emulsion or nicotine solution and soap.

Oyster-Shell Scale—See Apple.

Fungi.

Rusts—Occur on the leaves; similar in appearance and closely related to those on poplar. The alternate host for one species is the larch and apparently there is another whose alternate host is not yet determined. Rept. 1915, p. 450.

Prospective purchasers should write to these firms for catalogues and prices.

MANUFACTURERS OF SPRAYING MACHINES.

Aspinwall Manufacturing Co., Jackson, Mich. (Hand and power potato sprayers.)
Barnes Mfg. Co., Mansfield, Ohio. (Hand and power sprayers.)
Bateman Mfg. Co., Grenloch, N. J. (Iron Age sprayers for hand and power.)
Bean Spray Pump Co., Lansing, Mich. (Hand and power outfits.)
Brackett, Shaw & Lunt Co., Somersworth, N. H., 62 No. Washington St., Boston, Mass. (Hand and power outfits.)
Brown Co., E. C., Rochester, N. Y. (Compressed air, hand and power outfits.)
Church, Stephen B., Seymour, Conn., 64 Pearl St., Boston, Mass. (Power and hand sprayers.)
Crestline Mfg. Co., Crestline, Ohio. (Sprayers.)
Cushman Sprayer Co., St. Joseph, Mo. (Power outfits.)
Dayton Manufacturing Co., 2240 East Third St., Dayton, Ohio. (Hand sprayers.)
Deming Co., Salem, Ohio. (Hand and power outfits.)
Douglas, W. & B., Middletown, Conn., (Hand and power pumps.)
Field Force Pump Co., Elmira, N. Y. (Hand and power pumps.)
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Goulds Mfg., Co., 58 Pearl St., Boston, Mass.; 16 Murray St., New York. (Hand and power sprayers.)
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Hayes Pump and Planter Co., Galva, Ill. (Spray pumps.)
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Hurst Mfg. Co., H. L. Greenwich, Ohio.
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Bowker Insecticide Co., 43 Chatham St., Boston, Mass. (Insecticides and fungicides.)
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Frost Insecticide Co., 20 Mill St., Arlington, Mass. (Spray chemicals and apparatus).
General Chemical Co., 25 Broad St., New York. (General insecticides and fungicides, atomic sulphur and B. T. S.)
Glidden Co., Cleveland, Ohio. (Insecticides and fungicides.)
Grasselli Chemical Co., 80 Maiden Lane, New York. (Insecticides and fungicides.)
Heil Chemical Co., Henry, St. Louis, Mo. (Spray chemicals.)
Hemingway & Co., Inc., Bound Brook, N. J. (Arsenical poisons.)
Interstate Chemical Co., 12-20 Bay View Ave., Jersey City, N. J. (Insecticides and fungicides.)
Kentucky Tobacco Product Co., Louisville, Ky. (Nicotine solution.)
Kil-Tone Co., The, Vineland, N. J. (Insecticides and fungicides.)
Lavanburg Co., Fred L., 100 William St., New York. (Arsenical poisons.)
Leggett & Brother, 301 Pearl St., New York. (Insecticides and fungicides.)
Mechling Bros. Mfg. Co., Line St., Camden, N. J. (Insecticides and fungicides.)
Merrimac Chemical Co., 33 Broad St., Boston, Mass. (Lead arsenate.)

National Color and Chemical Works, Selling Agents for Taylor Chemical Co., 59th St. & 11th Ave., New York. (Carbon disulphide.)

Niagara Sprayer Co., Middleport, N. Y. (Dusting materials.)

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Robertson Co., The J. T., 147 Richmond Ave., Syracuse, N. Y. (Miscible oils.)

Roessler & Hasslacher Chemical Co., 100 William St., New York. (Cyanide.)

Sherwin-Williams Co., 601 Canal Road, Cleveland, Ohio. (Lime-sulphur and arsenical poisons.)

Smith Co., H. J., Utica, N. Y. (Insecticides and Fungicides.)

Thum Co., O. & W., Grand Rapids, Mich., 15 India St., Boston, Mass. (Tanglefoot.)

Vreeland Chemical Mfg. Co., 50 Church St., New York. (Insecticides and fungicides.)

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Dealers in spraying materials can usually be found in each town. Some of the larger firms are mentioned below.

Apothecaries Hall Co., 24 Benedict St., Waterbury. (Wholesale druggists.)

Barnes Bros., Yalesville. (Insecticides and fungicides.)

Cadwell & Jones, 1084 Main St., Hartford. (Pumps, insecticides and fungicides.)

Grasselli Chemical Co., River St., New Haven. (Insecticides and fungicides.)

Henry & Son, W. A., Blue Hills Farm, Wallingford. (Friend sprayers.)

Jewell, Harvey, Cromwell. (Agent for Hardie hand and power sprayers.)

Leete Co., The Chas. S., 299 State St., New Haven. (Wholesale druggists.)

Lightbourn & Pond Co., 39 Broadway, New Haven. (Pumps, insecticides and fungicides.)

Platt Co., The Frank S., 450 State St., New Haven. (Pumps, insecticides and fungicides.)

Sisson Drug Co., 729 Main St., Hartford. (Spraying machines and insecticides.)

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NEW HAVEN, CONN.

BULLETIN 224

G. P. CLINTON, Botanist

CONNECTICUT

Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 225 **JANUARY, 1921**

ENTOMOLOGICAL SERIES, No. 28

A STUDY OF THE BULB MITE.

BY PHILIP GARMAN.

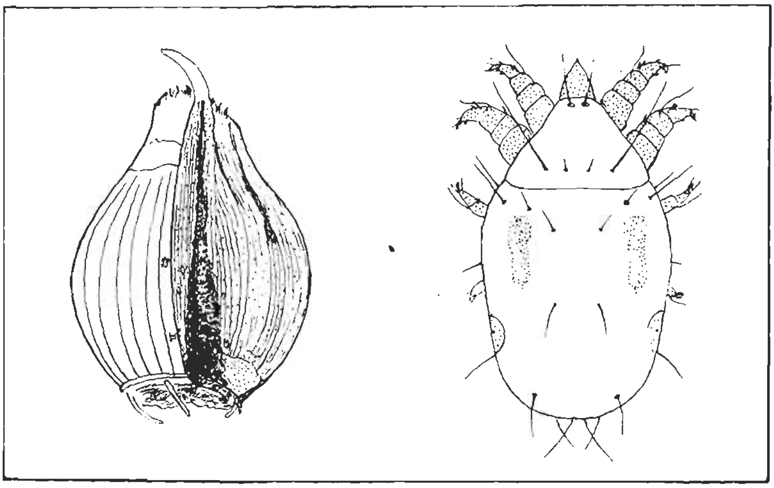

Figure 1. Section of infested bulb, and a mite greatly enlarged.

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Press of The Wilson H. Lee Company.

A Study of the Bulb Mite.

(*Rhizoglyphus hyacinthi Banks.*)

By Philip Garman, Ph.D.

Inspection of over a million bulbs in Connecticut during 1919 brought to light the significant fact that nearly all shipments contained the bulb mite *R. hyacinthi* Banks. In many shipments only a few infested bulbs were found, but in others as high as fifteen to twenty per cent. were apparently destroyed. Shipments were, however, frequently delayed in transit according to reports, a state of affairs doubtless responsible for the poor condition of many bulbs when they arrived at their destination. Rotten bulbs, too, are not always the result of mite infestation alone, there being several other causes of rot and disease—but the almost universal presence of the mites in decayed bulbs has led to the present study of the life history, habits and control of the pest.

Woods[1] claims that the Bermuda lily disease, caused in part by mite infestation, results in a yearly loss of 20 to 60 per cent. of the entire crop where the plants are forced. Destruction of bulbs has also been noted by many other American and European workers.

The injurious effects of the species in Connecticut were first described in the report of the State Entomologist for 1915[2], when 3000 Easter lilies were destroyed. Since then, no specific case in which extensive damage was done, has been reported to this office, but there is doubtless a small per cent. of loss each year which should be prevented by proper inspection, care and treatment of the mite-infested bulbs.

Distribution of the Species.

The bulb mite has been reported in foreign shipments to various states and to Canada. Shipments of bulbs to Connecticut come mostly from France, Belgium and Holland, but what is apparently the same species was found in one shipment received from Japan. It has also been reported in shipments of bulbs from the Bermuda Islands and thus seems to have a fairly wide distribution.

The Name of the Bulb Mite.

Banks[3] in 1906, listed under the name of *Rhizoglyphus hyacinthi* Boisduval a species of mite which he found in bulbs. Since that

[1] U. S. Dept. Agr. Div. Veg. Phy. & Path. Bul. 14: 1897.
[2] Conn. Agr. Exp. Sta. Rep. 190: 1915.
[3] Banks, N., Revision of the Tyroglyphidae, U.S.D.A. Bur.Ent.Tech. Ser.13: 21: 1906.

time Americans have religiously followed the name *hyacinthi* in preference to the name *echinopus* of European authors. Michael[1] however, places *hyacinthi* as a synonym of *echinopus*, with the remark that *hyacinthi* of Boisduval is a *nomum nudum* being listed without description. Michael is correct in this statement since the original description given by Boisduval is very meager and is not sufficient for purposes of identification. However, the description of *echinopus* given by Fumouze and Robin[2] shows that the latter may also have considered a different species; for the species in hand differs from it (and also Michael's description) in important particulars.

The most striking of these characters are the chitinous thickenings on the fourth pair of legs, which occur both in normal and heteromorphic males. Michael states that the only species bearing this character is *R. crassipes* Haller, which was originally described as an American species[3], but *crassipes* differs (in other particulars), from our species, and we are forced to conclude that either the chitinous thickenings have been overlooked or the species may be different from all described species. Inasmuch as Michael (l. c., p. 83) says emphatically that "there are not any suckers on the leg of the male of any species except *R. crassipes* Haller" we are able to conclude that he must have examined the species which he described, for this particular character. Examination of material from the U. S. National Museum shows chitinous thickenings on the fourth pair of legs in *R. hyacinthi* and *R. rhizophagus*. The rather frequent presence of the dimorphic male excludes the species in hand from *rhizophagus* and refers it to *hyacinthi*. As already intimated, a search through Boisduval's works has revealed no adequate description of this species and either his name *hyacinthi* must be disregarded or the authority changed from Boisduval to Banks. The latter course is to be preferred and the name *Rhizoglyphus hyacinthi* Banks instead of *Rhizoglyphus hyacinthi* Boisduval should be used, since Boisduval's name cannot be connected with any known species.

For convenience the description given by Boisduval is quoted herewith. Bank's description of the species is found in Bur. Ent. Tech. Ser. Bul. 13, p. 21, 1906 (pl. V fig. 49).

Description by Boisduval.

Entomologie Horticole p. 86: 1867.

"Nous ne trouvons mentionnè nulle part l'acarus de la Jacinthe, nous ne savons pa s'il n'a pas deja ete observé par quelque naturaliste. Nous lui donnons le nom provisoire d'acarus des Jacinthes *Acarus hyacinthi.*"

---

[1] Michael, A. D., British Tyroglyphidae II: p. 85: 1903.
[2] Jour. Anat. Phys., V: 287: 1868.
[3] Haller, Archiv Naturgeschichte, 50: 218: 1884.

General Description.

Egg (Fig. 2, No. 6),—The egg is ellipsoidal, white and semitransparent; .12 by .07 mm. in size.

Larva (Fig. 2, No. 2),—Small, white, somewhat ovoid in shape; genital suckers absent. Cephalo-thorax with two long setae on the frontal margin above, and two near the caudo-lateral angle; no minute bristles between the latter as in the adult; venter of the thorax with a clavate sense organ (Fig. 2, No. 3) between the bases of the first and second coxae on each side and small setae mesad of these; front tarsi with strong spines as in the adult, but the clavate hair much longer than the spine immediately beyond it; tip of the tarsus with three slender setae; front tibiae with the usual long setae on the dorsum, the patella (3rd segment from end beginning with tarsus) each with two shorter setae on the dorsum as in the adult. Abdomen with one pair of legs, the tarsi of each of which bears a long heavy spine and longer seta on the dorsal surface and three spines on the ventral; tarsal claw very stout; tibiae each bearing a single long seta on the dorsal surface; lateral margins of the abdomen with four setae on each side and a pair near the anal opening.

Size shortly after emergence from the egg, .15-.2 by .1 mm., full grown, .25 by .15 mm.

Protonymph (Fig. 2, No.1),—Similar to the larva in size and shape but larger and provided with four pairs of legs instead of three; rostrum as in adult; cephalo-thorax as in adult; with two long setae on the frontal margin of the dorsum and two near the caudo-lateral angle; no minute setae between the latter; the front tarsi have, in common with the adult, a minute clavate hair at the base and to one side of the large clavate hair; and between the larger clavate hair and the spine (immediately beyond) is a smaller spine about one-fifth the length of the latter; tip of front tarsi with three slender setae each. The fouth pair of legs has only one seta at the tip of the tarsus and there is no dorsal spine on that segment; however, there is a strong lateral spine and a ventral spine. Judging from the spines and setae on the tarsi of leg three in the larva and the protonymph, the fourth pair of legs of the protonymph must grow in behind the third pair of the larva.

This stage is most easily distinguished from the tritonymph, which it resembles more closely than other stages, by the appearance of the genital suckers. In the protonymph only two make their appearance while in the tritonymph there are three or four (see Fig. 2, No. 5). There is also some difference in the tarsi of the fourth pair of legs, the latter possessing no dorsal spine in this stage.

Length full grown, about .4 mm., width about .2 mm.

Deutonymph or **hypopus** (Fig. 2, No. 11),—Oval in shape, dorsum convex; venter flat; color brown, the body heavily reinforced throughout with chitin. Rostrum apparently reduced to a small cylindrical projection entirely covered by the cephalo-thorax; distal end of rostrum with two long setae, and a smaller one at the base of each. Mouth parts wanting; cephalo-thorax with two long setae on the front margin placed closely together, and about the same length as the long setae of the rostrum; legs for the most part without the heavy spines of the adult, the latter replaced in most cases by setae; tarsal claws long, curved rather sharply; tarsi of first pair of legs with four slender setae at tip and two near middle of ventral surface. There is also a heavy spine on the ventral surface; a large clavate hair nearly half as long as the segment, and a smaller clavate hair and small seta on caudal surface near the larger one. In front of the larger clavate hair there is also a long seta; front tibia with a long seta on dorsum and a single spine on each side; patella with a single seta at tip instead of two, as in all other stages. Abdomen with conspicuous expulsory vesicles on either side; margin composed of thick heavy chitin, which shows prominent striations under magnification; venter with conspicuous suckers as in Fig. 2, No. 11, one on each side of the

anal opening, two caudad of this, then a row of four, and finally two more Surrounding the eight caudal suckers is a squarish ring which is thickened at each of its four corners, making it appear as if four additional suckers were present; conspicuous lines of chitin on the venter, extending cephalo-mesad from the anal opening and each coxa of legs III and IV; third and fourth pair of legs short and usually hidden by the overhanging body wall when viewed from above; tarsi with four setae and two heavy spines at tip; tibiae with a long seta near tip, on dorsum; margin of abdomen with four, minute marginal setae.

Length, .2-.3 mm. Width .13-.18 mm.

Tritonymph (Fig. 2, No. 9),—Color white, translucent or semiopaque, legs brown or tinged with pink.

Rostrum and cephalo-thorax agreeing in nearly all particulars with the adult female. Abdomen as in the adult as regards setae; but the genitalia undeveloped; the genital suckers consist of four indistinct suckers closely approximated (Fig. 2, No. 9).

Length .5-.6 mm, width .3-.3.5 mm.

Adult (Fig. 3, Nos. 12-15; Fig. 2, Nos. 4, 5, 7 and 8),—Color white, body somewhat transparent; legs epimera and rostrum brown, sometimes with a pinkish hue.

Rostrum with large mandibles, which are chelate, maxillary palpi with two distinct segments closely joined to the rostrum and a very small projection at the tip, which may represent a third segment. Each of the longer segments with a minute seta, and a longer seta on each maxilla; cephalo-thorax narrowed rapidly in front, the sides gently curved, the front margin with two long setae extending beyond the rostrum and placed closely together; near the caudo-lateral angles of the dorsum are also two long setae between which are two usually minute hairs; venter of cephalo-thorax with conspicuous epimera, the front epimera being united on the mesal line; between the first and second epimera on each side there is usually a small seta; first two pairs of legs thicker than the last two, 5-segmented, the tarsi of the first pair provided with spines and setae as follows: a large clavate sense organ, near the proxima lmargin on the dorsum, and a large heavy spine just distad of this; a much smaller clavate hair at one side of the larger sense organ, about half its length: between the larger clavate sense organ first mentioned and the spine distad of it is a smaller spine about one-third its length; at the tip of the tarsus above there is also a large spine with three setae surrounding it, one of which is much smaller than the rest; ventrad of the tarsal claw there are usually three or four heavy spines, grouped together and another proximad of these; there is a long seta near the proximal spine and a very inconspicuous one on the opposite surface of the tarsus; tarsal claw not sharply curved; tibia with a long seta on the dorsum near the distal end which is often as long or longer than the tarsal segment; there is a single stout spine on the caudal and ventral surface of this segment; the patella has two closely placed setae near the distal margin of the dorsum and the femur has a single long seta on the ventral surface; the second tarsus is essentially the same as the first, except that the smaller clavate hair or sense organ, and the small spine (between the larger hair and the spine immediately distad) are wanting; one seta is also lacking from the tip; the third and fourth pairs of legs lack the clavate sense organs and are different in the two sexes. In the female and normal male the third pair of legs are similar; there is a long thick spine at the tip of the tarsus, above and below which is a long slender seta; on the caudal surface of this segment there is also one seta and there is a spine on the opposite surface; the ventral surface has a spine shortly distad of the middle and a group of about four ventrad of the tarsal claw; the latter is sharply hooked. The third pair of legs of the dimorphic male are much thicker than the third pair of the female or normal male. There are four long setae at the tip, and the tarsal claw seems to be fused with the

tarsal segment (Fig. 2, No. 10); the fourth pair of legs differ in the two sexes but are the same in dimorphic and normal males. In the female there is a distal spine on the tarsal segment just above the claw and one lateral (caudal surface) and one ventral spine in addition, besides a group of three just beneath the claw. There are usually three setae, one above and another below the distal spine and one lateral seta; in the male the distal dorsal spine is wanting, being replaced by a chitinous thickening sometimes called a sucker; proximad of this is still another thickening and between the two a single seta; the segment possesses the usual number of spines below the claw on lateral and ventral surfaces (Fig. 2, No. 7).

In the female the lateral surfaces of the abdomen are provided with about five setae on each side; the ventral surface with three minute setae on each side of the genital opening and one between the third and fourth coxae, a small one in front of and to one side of the third coxae and a long one on each side of the anal opening; the genital opening forms an inverted V-shaped figure with two genital suckers on each side (Fig. 3, No. 14); the dorsum has five setae on each side, of which the caudal pair are the longest.

In the male there are the usual five setae on lateral and caudo-lateral surfaces of the abdomen and one minute seta between the third and fourth pairs of legs on ventral surface, and a smaller one in front of and to one side of the third coxae; genital opening as in Fig. 3, No. 12 with two genital suckers on each side. Caudad of the genital opening are found two larger disc-like suckers, with a minute seta, caudad and cephalad, and usually a row of four longer ones caudad of the suckers; setae of the dorsum as in female.

Variations—There seems to be some variation both in the length of the setae of the legs and body and also in the thickness of the tarsal segments. Of seventeen individuals, however, measured with micrometer the ratio of width to length of tarsus IV ranged from 1-1.6 to 1-2.5, both sexes being examined. There is also a great variation in the depth of the depressions on the dorsum of the adult, they being almost obliterated in some individuals.

Length, female .47-.95 mm; male .5-.6 mm. Width, female .3-.4 mm; male .25-.3 mm.

Host Plants Infested and the Injury Resulting from the Infestation.

Narcissus (Plate I, b; II, a; III, b), hyacinth, tulip, crocus and Easter lily bulbs, are infested by the bulb mite. In the laboratory it has been reared on onions and potatoes, and is probably capable of subsisting on almost any tuber or bulb. Its common occurrence in narcissus and lily bulbs may be due to the fact that these bulbs offer least resistance to attack since the scales are loose and the mites find it easy to penetrate to the interior. Tulips are least injured, owing to their outer skin and tight-fitting scales which have no place for the mites to enter. Hyacinths seem to be less easy to penetrate than narcissus, while onions, artificially infested with mites, were not injured unless they were partly rotten or bruised in the beginning.

That the mites are able to feed on healthy tissue seems evident both from numerous references to this particular ability by various writers and from the experience of those connected with this office in the case of the Bermuda lilies already mentioned. A small

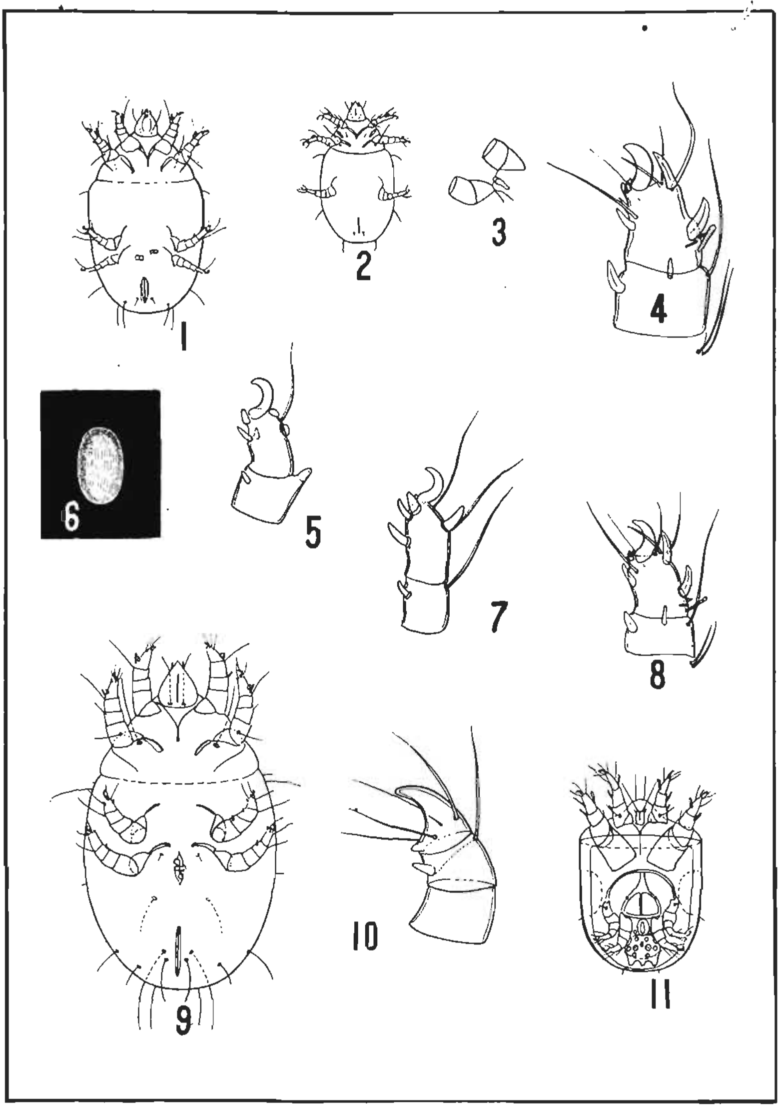

Figure 2. The bulb mite (*Rhizoglyphus hyacinthi* Banks). 1. Protonymph, enlarged about 80 times. 2. Larva, enlarged about 80 times. 3. Larva, sense organ of the ventral surface of the cephalothorax. 4. Front tibia and tarsus of the female. 5. Fourth tibia and tarsus of male. 6. Egg, enlarged about 80 times. 7. Fourth tibia and tarsus of the female. 8. Front tibia and tarsus of the female. 9. Tritonymph, enlarged about 80 times. 10. Fourth tibia and tarsus of dimorphic male. 11. Deutonymph or hypopus, enlarged about 80 times.

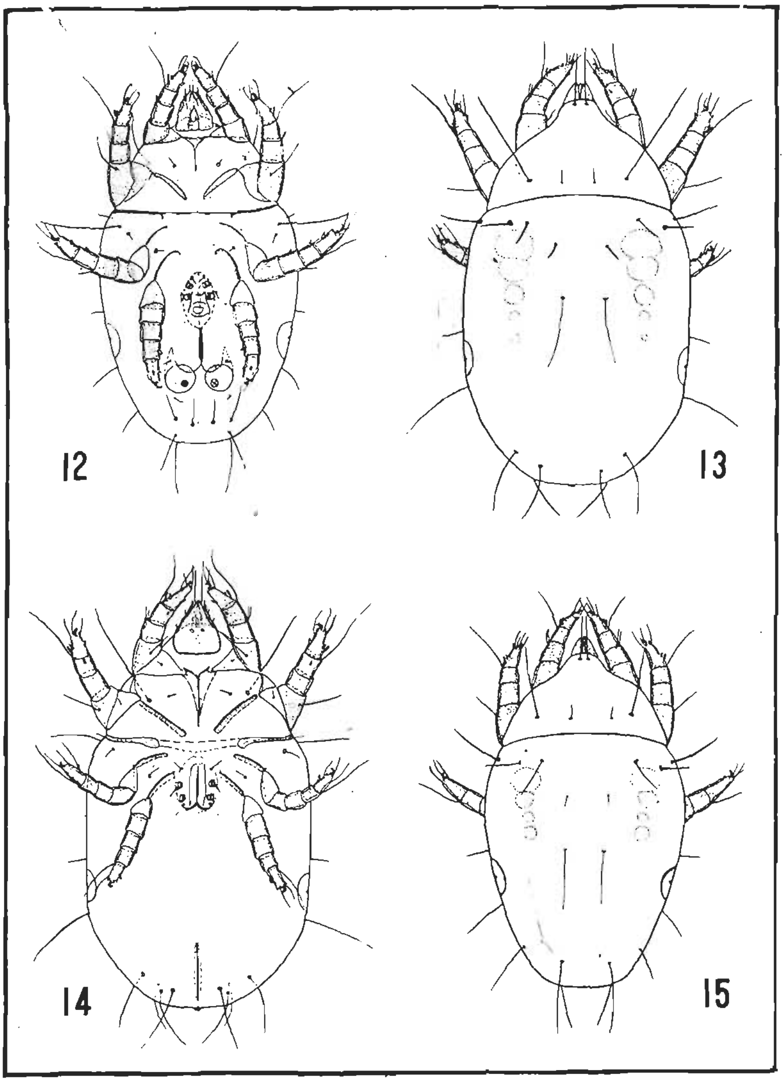

Figure 3. Adult bulb mite (*Rhizoglyphus hyacinthi* Banks), enlarged 80 times. 12. Male, ventral view. 13. Female, dorsal view. 14. Female, ventral view. 15. Male, dorsal view.

number of tests have been conducted by the writer in which mites entered and fed on growing narcissus bulbs. In these tests rotten bulbs containing mites were placed in pots of soil just below the healthy ones and the mites readily left the rotten and

entered the healthy bulbs. Plate I, b, shows one of the infected bulbs.

Welsford[1] claims that the rot of narcissus bulbs is transmitted by the minute worm or nematode, *Tylenchus devastatrix**, and not at all by the mite, *Rhizoglyphus echinopus*. This worm, however, has not been found in many of the rotten bulbs examined, while in few cases have mites been absent from diseased examples. Welsford himself admits that the bulb mite does a great deal of damage, but he does not consider it equal in importance to the nematode as a carrier of disease.

Life History.

Few people in America seem to have studied the life history of the bulb mite. The most recent work is that of Yagi[2], a Japanese, who published a preliminary note on the life cycle in 1919. In this, he makes known the following facts: "The mite moults twice and the duration of one generation is about ten days in August, and twenty in June. Temperature is the chief factor in this variation and has an important effect on the embryonic development—the number of eggs laid by one female varied from 9-59, each being dropped singly on the surface of the bulb. The larva is sluggish and bores in the tissues of bulbs and grape vines. The adults mate within 2-8 hours after reaching maturity and oviposition begins on the day of mating. The life of the female is about two to four weeks in summer while that of the male is shorter."

Michael[3] reports one case in which he reared *echinopus* from egg to adult in 33 days. He observes three moults instead of two as noted by Yagi. Careful studies by the writer indicate that *hyacinthi* moults three instead of two times, thus confirming Michael's statement in this regard. When hypopi appear, however, four moults accur instead of three. The life period obtained at room temperature 60-75° F. (averaging about 68°) varied from 17 to 27 days; with temperature ranging from 70-80° F., 9-13 days. The mite becomes torpid at 50-55° F. and at about 95°. The air in which the mites lived during the time they were observed was kept as near optimum humidity as possible, which condition was judged largely by daily observance of the amount of moisture contained in the lens paper with which each cell was provided.

The period of incubation lasts from 4-7 days. A six-legged larva emerges from the egg and the mite lives in this condition 3 to 8 days. The last day or so of this period, sometimes two

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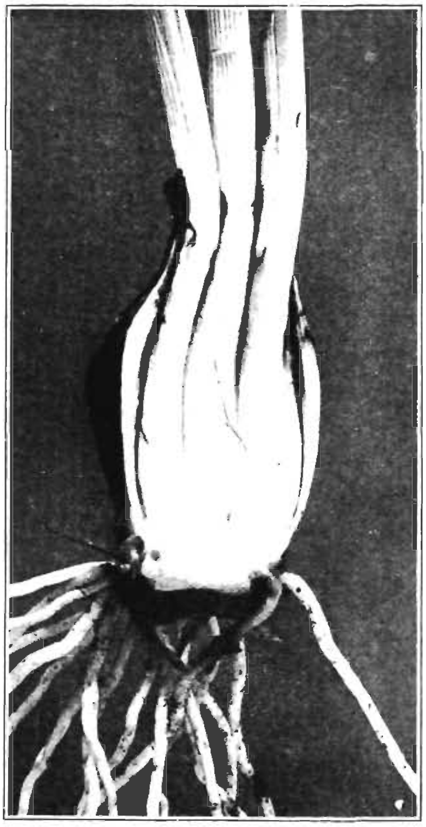
* Now *T. dipsaci* Kühn.

1 Welsford, E. J. Investigation of bulb rot of narcissus. Ann. Appl. Biol. 82: 36-46: 1917.

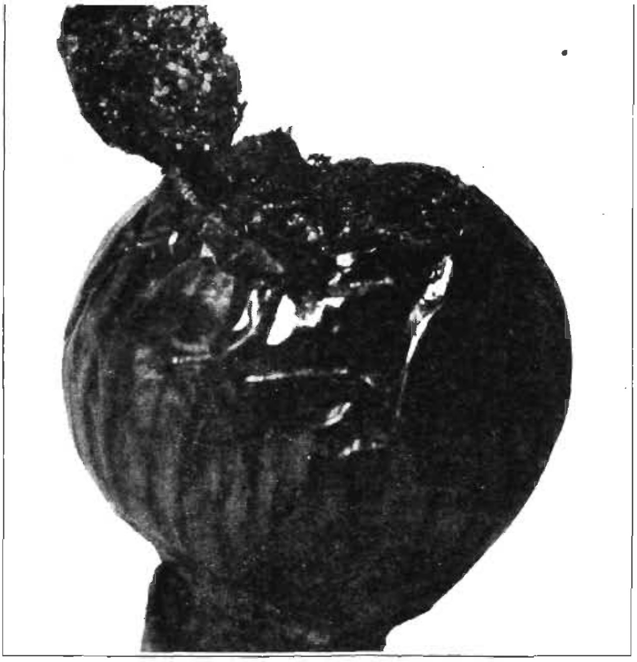
2 Yagi, N. Berichte Ohara Inst. Landwirtsch. Forschungen I: 349-360: 1918 Abstract in Rev. Appl. Ent., VII: 439-440: 1919.

3 Michael, A. D. British Tyroglyphidae. Vol. II: 92-93: 1903.

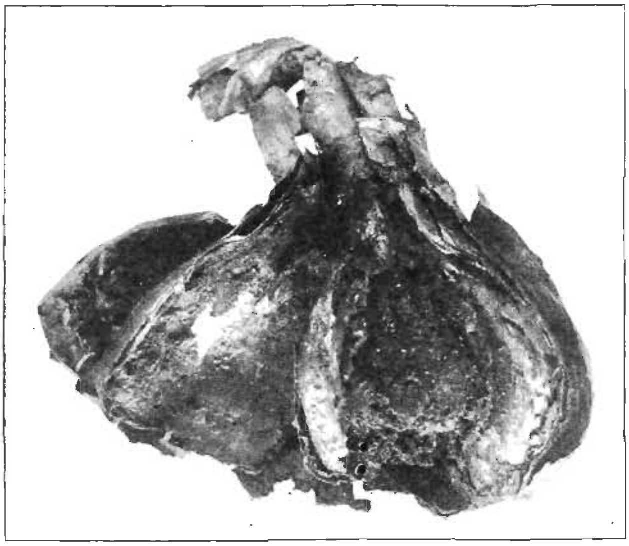
a. Flies, (*Scatopse pulicaria* Loew) with hypopi of the bulb mite clinging to them, enlarged 7 times.



b. Mite infestation just beginning in a growing bulb. Its progress is indicated by the dark lines between the scales, natural size.

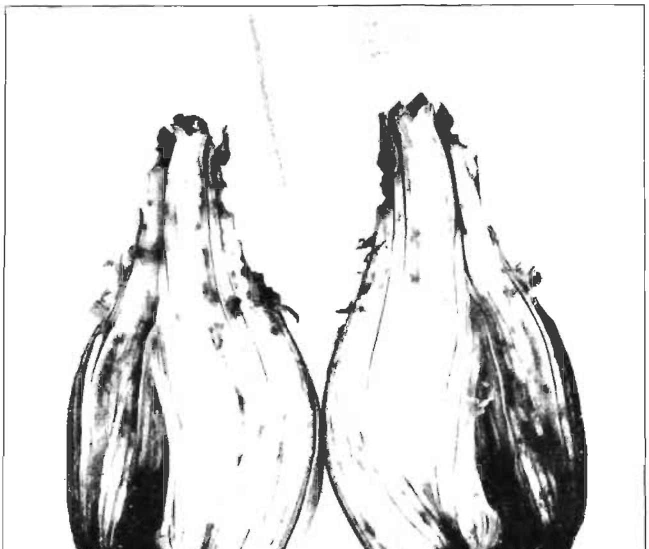


a. Rotten bulb with base removed showing mites, twice natural size.



b. Bulb completely destroyed and containing a great many mites, natural size.

a. Mites from a rotten bulb, enlarged 8 times.



b. Infestation just beginning in a healthy bulb, natural size.

days, is spent in a torpid or quiescent condition and at this time the larva swells so that the separating line between the thorax and abdomen is lost. On moulting the larva acquires two additional legs, making eight in all. The next period, which may be known as the protonymph* lasts two to four days, after which follows a second quiescent period of about two days and a second moult takes place. This time there is no increase in the number of legs or much change in form unless a hypopus or resting stage is produced. If normal in form the mite, now known as the tritonymph*, again goes into the quiescent state which lasts 1-2 days; and moults. The adult mite then emerges. If, however, the hypopial state appears after the second moult, the mite may rest for one or two weeks or more, afterwards moulting and giving rise to the tritonymph. The latter then moults and the adult mite emerges as before.

Adults mate a day or so after becoming mature and the eggs are soon laid, beginning with a few daily at first and later increasing in number up to six or eight. Two females observed laid ten eggs per day for four successive days, but this is rather unusual. The number of eggs laid has been found to vary considerably, some females laying more than one hundred, others laying only a few. One individual laid 130 eggs in all, while one other laid 81, and still another 59. The males usually die shortly after mating, but if kept separate have been observed at this laboratory to live for more than two months. Females also live from one to two months or more if properly fed and cared for.

The following shows the course of the life history:

Cycle in which hypopial stage is skipped.

Egg—larva—first nymph—third nymph—adult female.
Egg—larva—first nymph—third nymph—dimorphic male adult,
normal male adult.

Cycle with hypopial stage.

Egg—larva—first nymph—hypopus—third nymph—adult female.
Egg—larva—first nymph—hypopus—third nymph—dimorphic male adult,
normal male adult.

The Dimorphic or Heteromorphic Male.

The dimorphic male with enlarged third pair of legs (Fig. 2, No. 10) has been thought by some to be a distinct species, but it has been definitely proven by others to be merely a form of more or less infrequent occurrence. In one lot of mites examined 36 males were seen without encountering a single dimorphic form. In other lots the males with and without enlarged legs appeared in about equal numbers. The dimorphic males breed freely and the offspring consists of both females and normal and heteromorphic

* The hypopus is regarded as the deutonymph, and is frequently interpolated between protonymph and tritonymph.

males. One specimen was seen with an enlarged third leg on one side and a leg of normal size on the other. The exact function of the dimorphic male is not clearly understood, nor do we understand the causes which bring about such remarkable differences in this sex.

The Hypopus.

Rather complete studies of the hypopus of *echinopus* have been made by Michael and other European authorities, and it is now regarded as a normal period in the life history of the mite. Briefly explained, it is a form similar to some of its ancestors which is produced from time to time from no apparent reason other than a strong tendency to revert to type and "is a provision of nature for the distribution of the species occurring irrespective of adverse conditions[1]". Notwithstanding, the fact remains that is often impossible to distinguish between favorable and unfavorable conditions and it seems certain that conditions promoting their development are not always at hand. The following notes relate to the development of the hypopus.

First of all it has appeared that hypopi are much more numerous in jars where the bulbs are rotted enough to leave them in a wet, sticky condition. Hypopi are produced in dry as well as moist cells, but more rapidly and frequently more abundantly in the moist cells. This was demonstrated by use of a moisture gradient consisting of four hanging drop slides with small cells, clamped to a larger piece of glass and with a sheet of lens paper between; one end of the gradient being placed in moist sand, and each cell provided with a single pair of mites and the necessary food. The following shows the results of three tests with the gradient described. Cell No. 1 in each case was in contact with moist sand, 2, 3 and 4 further away in the order mentioned. These tests were then repeated with similar results.

No. of cell.	No. of mites.	Per cent. of hypopi.	Food used.	Date Begun.	Date Examined.
1	111	27	Unfermented dry narcissus.	May 14	July 7
3	83	7	"	" "	" "
4	90	0	"	" "	" "
			Fermented		
2	39	82	hyacinth.	" "	" "
3	14	50	"	" "	" "
4	105	0	"	" "	" "
			Fresh		
1	213	25	narcissus.	July 24	Sept. 9
2	60	10	"	" "	" "
3	21	0	"	" "	" "
4	60	0	"	" "	" "

[1] Michael, A. D. The hypopus question, or the life-history of certain Acarina. Jour. Linn. Soc., Zool., XVII; 389; 1884.

On April first a small tightly corked bottle was provided with about an inch of moist sand and a number of slices of potato previously infested with the bulb mite. These mites did not multiply rapidly but reproduced fairly well and on June 8, 100 individuals were counted without encountering a single hypopus. Little or no fermentation took place in the bottle until after this date and most of the eggs were laid on the outside of the potato and were fairly dry. However, where the potatoes were in contact with the sand there was considerable moisture surrounding the developing mites. Only one hypopus was seen in the bottle until July 1. During the latter part of July mold obtained a foothold on the potato but the mites continued to breed, many of them being covered with a wet sticky film. However, even under such conditions less than one per cent. of hypopi developed—as was seen by examination on September 9. In order to test the natural ability of the strain on potato to produce hypopi, mites were transferred to glass cells with narcissus or hyacinth at several different periods during the course of the experiment. Hypopi were produced abundantly in practically every case the percentage varying from 10 to 80%. In this bottle and five other similar ones made from it hypopi did not begin to appear in numbers until about October 25, making *a period of some six months when they did not develop. It is* difficult to explain the appearance of the hypopus in small cell transfers, but it seems as if some necessary change in conditions must have taken place.

Hypopi developed in light and dark, when fed on decayed and sound food, in moist and dry cells and apparently when warm and cold. They also developed about equally well when the food was covered with small amounts of sugar, alcohol (2%) and acetic acid (1%).

Michael used many experiments to try to induce certain species of Tyroglyphids to develop without producing hypopi, but failed; and he concluded that hypopus is a normal stage in their development. Notwithstanding, in the case of mites like the bulb mite in which all individuals do not pass through the hypopus stage, it seems hazardous to ascribe such a phenomenon entirely to the inherent atavistic tendency or natural habit of the individuals. It is well known that in a somewhat similar life cycle found in aphids, reversion to the sexual forms which are more commonly skipped are induced largely by changes of weather and food. Some species of aphids, moreover, may be reared continuously without reversion, when proper conditions of moisture, temperture, etc., are maintained, and it seems as if something similar must be true of the mites under investigation, caused by factors which we have not yet learned to recognize.

The length of the hypopus stage under favorable conditions is usually about one to two weeks.

Migration of the Species.

The hypopus is much more active than the remaining stages in the life cycle of the mite, and has a tendency to wander from place to place. It will also attach itself to any moving object. At the time when hypopi become numerous, the bulbs are commonly well rotted and infested by numerous small fly larvae, one of which (*Scatopse pulicaria* Loew) (Plate I, a) was found in large numbers. The flies of this species were frequently found to be literally covered with hypopi attached by means of their ventral suckers. Other hypopi were seen riding peacefully on the backs of predaceous mites, and still others have been found attached to lepidopterous larvae. The mite is thus afforded an admirable means of transportation, of which it is capable of taking full advantage because of its structure and habits.

The tables below show the length of the various stages as determined at this laboratory.

Tabular Life History of the Bulb Mite

LENGTH OF EGG STAGE.

Length of stage days.	Number observed.	Dates.
		1919.
	Temperature 60°-75° F.	
7	8	Sept. 29-Oct. 6.
6½	3	Oct. 10-Oct. 17.
7	4	Oct. 10-Oct. 17.
6½	4	Oct. 10-Oct. 17.
		1920.
	Temperature 70°-80° F.	
4	2	July 15-July 19.
3	2	July 16-July 19.
4	3	July 16-July 20.
4	8	July 16-July 20.

LENGTH OF LARVAL STAGE.

Length of stage days.	Number observed.	Dates.
		1919.
	Temperature 60°-75° F.	
8	1	Oct. 3-Oct. 10.
6	1	Oct. 6-Oct. 11.
7	2	Oct. 6-Oct. 12.
6	2	Oct. 17-Oct. 21.
6	1	Oct. 17-Oct. 22.
6	2	Oct. 17-Oct. 22.
6½	2	Oct. 16-Oct. 21.
		1920.
	Temperature 70°-80° F.	
2	2	July 19-July 21.
3	8	July 20-July 23.
3	2	July 18-July 21.
4	1	July 19-July 23.
5	3	July 19-July 24.

LENGTH OF FIRST NYMPHAL STAGE (PROTONYMPH).

Length of stage days.	Number observed.	Dates.
		1919.
	Temperature 60°-75° F.	
3	1	Nov. 10-Nov. 13.
3	1	Nov. 12-Nov. 15.
4	1	Nov. 11-Nov. 15.
3	1	Nov. 8-Nov. 11.
4	1	Nov. 8-Nov. 12.
8	1	Nov. 16-Nov. 24.
5	1	Nov. 19-Nov. 24.
3	1	Nov. 20-Nov. 23.
2	1	Nov. 20-Nov. 22.
		1920.
	Temperature 70°-80° F.	
2	1	July 21-July 23.
2	1	July 21-July 23.
2	1	July 21-July 23.
1	2	July 21-July 22.
2	2	July 21-July 23.

LENGTH OF HYPOPUS STAGE (DEUTONYMPH).

Length of stage days.	Number observed.	Dates.
		1920.
	Temperature 65°-75° F.	
12	1	March 15-March 27.
7	1	March 29-April 5.
5	1	April 17-April 22.
7	1	April 10-April 17.
13	1	April 10-April 23.

LENGTH OF THIRD NYMPHAL STAGE (TRITONYMPH).

Length of stage days.	Number observed.	Dates.
		1919.
	Temperature 60°-75° F.	
4	1	Nov. 15-Nov. 19.
3	1	Nov. 11-Nov. 14.
4	1	Nov. 12-Nov. 16.
3	1	Nov. 24-Nov. 27.
3	1	Nov. 23-Nov. 26.
4	1	Nov. 22-Nov. 26.
		1920.
	Temperature 70°-80° F.	
3	1	July 23-July 26.
3	1	July 24-July 27.
2	1	July 25-July 27.
3	1	July 24-July 27.
2	1	July 23-July 25.
2	2	July 22-July 24.
2	1	July 23-July 25.

Variations obtained in length of life cycle 9-29 days (with hypopus absent from the cycle); with hypopus included 14-42 days.

Other Species of Mites and Predaceous Enemies.

Several predaceous mites (Parasitidae) and the Tyroglyphid, *Histiostoma rostro-serratus* have been found frequently, but the

Tests of Various Oils.

Insecticide used.	Strength of material used.	Length of exposure.	Number alive.	Number dead.	Per cent. killed	Dates. 1919.	Notes.
Fir tree oil*	1 pt.**—320 pts. water	2 min.	23	143	86.1	10/17	All *stages included*.
Scalecide	1 pt.—25 pts. water	2 min.	400	3	.7	10/17	" " "
"	1 pt.—15 pts. water	10 min.	500	0	0	11/20	" " "
Lemon oil	1 pt.—100 pts. water	½ hr.	149	1	.6		
" "	1 pt.—10 pts. water	½ hr.	10	0	0		Hypopi only.
" "	1 pt.—25 pts. water	2 hrs.	48	2	4.0	12/13	" "
Schnarr's Insecticide	1 pt.—100 pts. water	2 min.	100	0	0	10/17	
" "	1 pt.—50 pts. water	10 min.	200	2	.9	11/20	
Check (soaked in tap water)		10 min.	135	5	3.5	11/20	

Tests of Fumigants.

Carbon disulphide	1 oz.—100 cu. ft.	24 hrs.			50	11/17	Room temperature.
" "	1 oz.—100 cu. ft.	48 hrs.	4	106	96.0	11/20-22	" "
" "	1 oz.—100 cu. ft.	48 hrs.	36	11	23.4	11/20-22	Room temperature; hypopi only.

Tests of Heat, Nicotine, Formalin and Combinations Thereof.

Insecticide used.	Strength of Insecticide.	Length of exposure.	Number alive.	Number dead.	Per cent. killed	Dates 1919.	Notes.
Heat	70° C.	1 hr.	0	200	100	11/30	Mites put in stoppered bottles and heated in an oven with gas. All hypopi and mites on interior of bulb were dead at end of period.
"	49° C.	1 hr.	98	2	2	12/2	
"	49° C.	1 hr.	8	2	20	12/2	

* This insecticide is now difficult to obtain on the market.
** Pt. equals part.

Hot water	50° C.		1 hr.	0	140	100	12/2	No hypopi seen.
" "	50° C.		10 min.	0	100	100	12/3	" " "
" "	50° C.		10 min.	8	2	20	12/3	Hypopi only.
" "	55° C.		10 min.	0	50	100	12/16	
" "	55° C.		10 min.	0	10	100	12/16	Hypopi only.
" "	60° C.		10 min.	0	200	100	12/5	Temperature fell from 60° at beginning to 52° at end of period.
" "	60° C.		20 min.	0	200	100		Hypopi and all mites on interior of bulb were killed.
40% Formalin	50° C.	1-20 (2%)	2 min.	16	38	70.3	12/23	Hypopi and normal mites observed alive.
40% "	50° C.	1-20 (2%)	10 min.	0	32	100	12/23	Hypopi only.
Nicotine sulphate	R*	1-800	2 min.	500	50	9.0	11/17	Some of mites on interior of bulb were dead.
Nicotine sulphate and soap	R	1-400 soap 2 lbs. 50 gals.	10 min.	64	11	14.6	11/20	
Nicotine sulphate and soap	R	" " "	24 hrs.	221	17	7.1	11/20	
							1920.	
Nicotine sulphate	51° C.	1-400	5 min.	0	110	100	1/17	Hypopi only.
" "	50° C.	1-400	10 min.	10	131	92.9	11/26	No hypopi. Many mites on interior of bulb killed.
Nicotine oleate	R	Moore's** formula	10 min.	2	14	87.5	1/14	Very few hypopi.
Nicotine oleate	50° C.	Moore's formula	5 min.	2	48	96	1/14	Hypopi only.
" "	50° C.	" "	5 min.	0	50	100	1/14	Normal mites only.
" "	50° C.	½ strength of above.	5 min.	0	21	100	1/15	Hypopi only.
" "	50° C.	Same as above.	5 min.	0	100	100	1/15	Normal mites.
Check (no treatment)				60	0	0	1/19	Hypopi only counted.

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*R = room temperature. Tap water used at about 20° C.

**Nicotine oleate made by combining 10 parts kerosene with 1¼ parts commercial oleic acid, and then 2½ parts of 40% nicotine solution. 10 parts of water were added and the whole quantity then mixed with 480 parts of tap water. See Jour. Econ. Ent. XI: 342, 1918. The oleic acid from which nicotine oleate is prepared is difficult to obtain.

latter seems to flourish best in wet rotten bulbs and has not been observed to feed on healthy tissue. The small hypopus of this species is produced abundantly and frequently attaches itself to *Rhizoglyphus* or any insect which lives within the bulbs. *Histiostoma* is much smaller than *Rhizoglyphus* as is also the hypopus, compared with that of the bulb mite. When observed feeding the adult is much lighter in color and the caudal margins of the abdomen are less rounded. The predaceous species (Laelaptini) are very active brown mites slightly larger than the true bulb mite. In one box of bulbs containing about one-fourth bushel, these enemies became very numerous and were seen running about over the bulbs like ants. Doubtless they had destroyed many bulb mites. In another case a Mason jar containing many bulb mites was entirely cleared of *Rhizoglyphus* in about a month after the predaceous species was first noticed in the jar.

The small Cecidomyid fly *Lestodiplosis* sp.* was also found feeding upon the bulb mite. The larva is a small, pinkish maggot about one mm. in length, which crawls about among the mites and feeds on them.

Control Measures.

Morphological studies show that the mite has no tracheal system and cannot be killed, theoretically, by ordinary fumigants. Ewing[1] demonstrated that 4.1 oz. of potassium cyanide per 5470 cu. ft. or 1 oz. per 133 cu. ft. of air space was insufficient to kill the bulb mite. Fumigation at this laboratory with carbon disulphide in an air tight container, 1 oz. to 100 cu. ft. required 48 hours to obtain a good kill. Mites on the interior of the bulbs were not killed even with this length of exposure. Sorauer[2] recommends for use against the mite, *R. echinopus*, the use of a 48 hour carbon disulphide fumigation or immersion in tobacco extract. 40% nicotine sulphate 1-400 with the addition of soap killed only 7.1% in tests conducted here. Fir tree oil was considerably more efficient, killing 60-90% in some instances, while in bulbs soaked in water heated to 55° C. nearly 100% were killed. Woods[3] treated bulbs with mercuric chloride 1-1000 and 1-2000, formalin 1-1000 and 1-2000 without success. A good kill, however, was obtained by the writer with formalin heated to 50° C. (122° F.), the bulbs being left for a period of ten minutes. Nicotine sulphate 1-400 heated to 50° C. (122° F.) and nicotine oleate heated to 50° were also very successful acaricides.

In all cases careful observations were made on the hypopus because of its greater resistance, and the mites were examined daily for three days after treatment to be sure of results.

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* Determined by Dr. E. P. Felt.

[1] Ewing, H. E. Oregon Agr. Exp. Sta., Bul. 121: 70: 1914.

[2] Sorauer P. Pflanzenkrankheiten III: 109: 1913.

[3] Woods, A. F. U. S. Dep. Agr., Div. Veg. Phy. & Path., Bul. 14: 1897.

For convenience, the different treatments and practices for control the pest, will be enumerated.

UNSUCCESSFUL TREATMENTS.

1. Hydrocyanic acid gas (HCN) fumigation, the gas obtained by usi potassium cyanide 1 oz. to 133 cu. feet of air space[1].
2. Carbon disulphide 1 oz.-100 cu. feet—24 hr. fumigation.
3. Formalin 1 part-1000 parts water and 1 part-2000 parts water—col
4. Nicotine sulphate 1 part-400 parts water plus soap 2 lbs.-50 gals.—col
5. Schnarr's insecticide 1 part-100 parts water.
6. Scalecide 1 part-15 parts water.
7. Mecuric chloride 1 part-1000 parts water and 1 part-2000 parts wate

PARTLY OR ENTIRELY SUCCESSFUL TREATMENTS.

1. Carbon disulphide 1 oz.-100 cu. feet—48 hour fumigation.
2. Nicotine sulphate 1-400 heated to 50° C. (122° F.)—bulbs immers for 10 min. Also nicotine oleate at the same temperature.
3. Formalin (2%) heated to 50° C; bulbs immersed for 10 minutes.
4. Hot water 55° C. (131° F.)—bulbs immersed for 10 minutes.

PRACTICES OF VALUE IN GETTING RID OF THE MITE.

1. Selection of bulbs to be planted; all soft and rotten bulbs to be di carded.
2. Proper care and fertilization of the growing plants.
3. Cold storage 33-35° F. (any temperature below 50° F.) to preve multiplication of the mites while stored.

TESTS OF TREATMENTS FOR NARCISSUS BULBS TO DETERMINE WHAT INJURY IF ANY RESULTS THEREFROM.

Insecticide Used	Temperature of Insecticide	Period of Treatment	Date of Treatment	Amount of Injury	Date of Examination	No T.
Nicotine Sulphate 1-400 Soap (2 lbs.—50 gals.)	50° C.	10 min.	1920 Aug. 31	None	1920 Nov. 28	
Nicotine Sulphate 1-400 Soap (2 lbs.—50 gals.)	50° C.	5 min.	Aug. 31	None	Nov. 28	
Formalin 2%	50° C.	10 min.	Aug. 31	None	Nov. 28	
Nicotine Sulphate 1-400	50° C.	10 min.	Aug. 31	None	Nov. 28	
Nicotine Sulphate 1-400 Soap (2 lbs.—50 gals.)	45° C.	10 min.	Aug. 31	None	Nov. 28	
Nicotine Sulphate 1-400 Soap (2 lbs.—50 gals.)	45° C.	5 min.	Aug. 31	None	Nov. 28	
Check, no treatment	....	....	Aug. 31	None	Nov. 28	

[1] Ewing, H. E. Oregon Agr. Exp. Sta., Bul. 121: 70: 1914.
[2] Woods, A. F. U. S. Dep. Agr., Div. Veg. Phys. and Path., Bul. 14: 1897

A few tests were conducted with narcissus bulbs in order to be sure that no injury results from the more successful treatments. Ten narcissus bulbs were first heated to 59-65° C. in hot water and left for a period of one-half hour. Two bulbs were retained as checks. All treated bulbs were killed, but the checks remained healthy and grew. Shortly after, two narcissus bulbs were treated with hot water at a temperature of 50° C. for ten minutes. These bulbs had fresh roots about one inch in length. Two bulbs were retained as checks. All bulbs grew, but the untreated were seen to be in better condition at time of blooming and on removing from the pots, the original roots of the treated were found to be dead and a new lot in their place. The table above is a continuation of these tests and shows that a temperature of 50° C. is non-injurious to narcissus, if the bulbs are without fresh roots and the period of immersion is not great.

Paper white narcissus were used in these tests and none of the bulbs had any fresh roots. Some of the treated bulbs grew better and were more vigorous than the checks. All bulbs grew and the plants were approximately the same height at the conclusion of the test.

Conclusions.

1. The bulb mite is capable of injuring healthy growing bulbs.
2. It is spread from place to place chiefly by means of the hypopus, which clings to small flies emerging from the decayed bulbs.
3. The life cycle may be completed in less than a month (9-29 days), or may be extended to a month and a half if the hypopial stage develops or if adverse conditions prevail.
4. One of the most satisfactory means of killing the mites was found to be that of dipping the bulbs in nicotine sulphate 1-400 or nicotine oleate, heated to 50° C. Hot water (50° C.) also kills a good percentage.
5. The authority commonly given for the scientific name should be changed to Banks and the name should read *Rhizoglyphus hyacinthi* Banks.

TWENTIETH REPORT

OF THE

STATE ENTOMOLOGIST

OF

CONNECTICUT

FOR THE YEAR 1920

(Being Bulletin 226 Connecticut Agricultural Experiment Station)

BY

W. E. BRITTON, Ph. D.

State Entomologist

New Haven, Conn.

1921

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NOTE REGARDING AUTHORSHIP.

For bibliographical purposes, all matter in this Report (Bulletin 226) except where otherwise indicated, should be credited to W. E. Britton.

BULLETIN 226

TWENTIETH REPORT

OF THE

State Entomologist of Connecticut

To the Director and Board of Control of the Connecticut Agricultural Experiment Station:

I transmit, herewith, my twentieth report as State Entomologist of Connecticut, covering the activities of the year of 1920. The financial statements are for the state fiscal year ending June 30, 1920. This report contains an account of the various lines of work placed upon the office by Statute such as inspecting nurseries and apiaries, and suppressing the gipsy moth, and articles dealing with the mosquito work of the year, the European red mite and the apple and thorn skeletonizer, two new orchard pests, life history notes on the false apple red bug, a sawfly feeding upon Austrian pine and miscellaneous notes on various economic insects.

Respectfully submitted,

W. E. BRITTON,
State and Station Entomologist.

REPORT OF THE RECEIPTS AND EXPENDITURES OF THE STATE ENTOMOLOGIST FROM JULY 1, 1919, TO JUNE 30, 1920.

RECEIPTS.

From E. H. Jenkins, Treasurer	$7,500.00	
Account of 1919, Balance	1,889.75	
State Comptroller, Gipsy Moth Account	729.21	
M. P. Zappe, Automobile Mileage	10.68	
W. E. Britton, Automobile Mileage	5.10	
Interest on Bank Deposits	40.06	
Sale of old paper	3.45	
	———	$10,178.25

EXPENDITURES.

For Field, Office and Laboratory Assistance:	
B. H. Walden,* salary	$1,499.97
M. P. Zappe, salary	1,750.00
Philip Garman, salary	1,666.62
K. F. Chamberlain,† salary	800.00

*For nine months: remainder paid from mosquito appropriation.
†For eight months: resigned March 1, 1920.

Gladys M. Finley, salary	$704.00		
George D. Stone, salary	359.78		
Other assistance	217.60		
	———	$6,997.97	
Printing and Illustrations		36.10	
Postage		80.46	
Stationery		21.69	
Telegraph and Telephone		1.80	
Office Supplies		82.24	
Library		183.46	
Laboratory Supplies		611.65	
Express, Freight and Cartage		26.40	
Rental and Storage		1.45	
Traveling Expenses		719.23	
Insurance		65.85	
Automobile tires and repairs		499.51	
Balance, Cash on Hand		850.44	
		———	$10,178.25

Memorandum:—This account of the State Entomologist has been audited by the State Auditors of Public Accounts. The item of $729.21, credited as having been received from the State Comptroller is really a transfer from the appropriation for suppressing gipsy and brown-tail moths and for inspecting imported nursery stock, and covers the time and automobile mileage of members of the department staff while engaged in inspecting imported nursery stock.

Summary of Inspection and Office Work.

256 samples of insects received for identification.
95 nurseries inspected.
92 regular certificates granted.
35 parcels of nursery stock inspected and certified.
65 orchards and gardens examined.
17 shipments, containing 87 cases, 814,491 plants imported nursery stock inspected.
11 shipments, or 64 per cent. found infested with insects or fungi.
762 apiaries, containing 4,797 colonies, inspected.
33 apiaries, containing 72 colonies, found infested with European foul brood.
9 apiaries, containing 12 colonies, found infested with American foul brood.
2,576 letters written on official work.
646 circular letters.
454 post cards.
17 reports of inspection to Federal Horticultural Board.
1,007 bulletins, etc., mailed on request or to answer inquiries.
66 packages, sent by mail or express.
25 lectures and addresses at institutes, granges, etc.

Publications of Entomological Department, 1920.

By W. E. Britton:

Nineteenth Report of the State Entomologist (Bulletin 218), 100 pages, 5 figures, 24 plates, 10,500 copies distributed in May, 1920.

Insects Attacking Squash, Cucumber and Allied Plants in Connecticut (Bulletin 216), 21 pages, 9 figures, 8 plates; 10,000 copies distributed in February, 1920.

Report of Committee on Injurious Insects, Report of Connecticut Vegetable Growers' Association for 1919, page 51, 1920.

Report of Committee on Injurious Insects, Proceedings Twenty-Eighth Annual Meeting Connecticut Pomological Society, page 15, 1920.

Some Phases of Beekeeping in Connecticut, Journal of Economic Entomology, Vol. 13, page 91, February, 1920.

A Connecticut Cornfield Injured by *Crambus præfectellus* Zinck, Journal of Economic Entomology, Vol. 13, page 222, April, 1920.

More About the Cyclamen Mite, Florists' Exchange, Vol. XLIX, page 285, February 7, 1920.

Department Staff and Work.

W. E. Britton, Ph.D., *State and Station Entomologist.*

Assistant Entomologists:

- B. H. Walden, B.Agr., *Photographic and General Work.*
- Irving W. Davis, B.Sc.* *Deputy in Charge of Moth Work.*
- M. P. Zappe, B.S., *Inspection and General Work.*
- Kenyon F. Chamberlain,† *Inspection and General Work.*
- Philip Garman, Ph.D., *Research Work.*
- John T. Ashworth,‡ *Acting Deputy in Charge of Moth Work.*
- Samuel T. Sealy,§ *Deputy in Charge of Mosquito Work.*

Miss Gladys M. Finley, *Clerk and Stenographer.*

Apiary Inspectors:

- H. W. Coley, Westport,
- A. W. Yates, Hartford,

There have been a few changes in the department staff during the year. Mr. Chamberlain resigned March 1, after a year's service. Mr. Davis, who for nearly seven years has been in charge of the work of suppressing the gipsy and brown-tail moths, resigned June 10 to accept a position with the Danielson Trust Company, of Danielson. Mr. Davis was very successful in his work and it was with much regret that we accepted his resignation. Mr. Ashworth has been placed temporarily in charge of the gipsy moth work.

Mr. Sealy was appointed deputy to the Director in charge of mosquito drainage work and began his duties April 19. Mr. Sealy formerly was employed in this kind of work by the Nassau County, N. Y., Mosquito Extermination Association.

Mr. Walden, who has been in charge of mosquito work for about four years, has this season been engaged in photographic work, inspection, and general work, and has been in charge of the department in the absence of the Entomologist. He has made photographic illustrations for the plates of the Connecticut Hemiptera and has collected an excellent series of leafhoppers from various hosts in different parts of the state.

Mr. Zappe has been in charge of the inspection of nurseries and of imported nursery stock. He has also aided in some orchard spraying and dusting experiments, and has studied the life histories of the false apple red bug, a leafhopper on apple, and a sawfly, (*Itycorsia zappei* Rohwer) feeding on Austrian pine.

---

*Resigned June 10.
†Resigned March 1.
‡Beginning June 10.
§Beginning April 19.

Dr. Garman has been engaged in studying the life history of the bulb mite, the results of which have been published as Bulletin No. 225. He has also commenced an interesting study of the life history of the frog hoppers or spittle insects (family Cercopidae) and is also at work on the mites of Connecticut and the Odonata or dragonflies of Connecticut, the results of which will be published by the Geological and Natural History Survey of the State.

The Entomologist has spent considerable time in revising manuscript and reading proof on the Check List of the Insects of Connecticut, which has appeared as Bulletin 31 of the Geological and Natural History Survey, and in editing and writing a portion of the manuscript of the Hemiptera of Connecticut which will also be published as a later bulletin of the Survey.

Miss Finley has continued as clerk and stenographer, and during a part of May when on her vacation, the necessary work was done by a substitute, Miss Marion D. Pickett.

Messrs. Coley and Yates as heretofore have inspected the apiaries, working by the day.

From August 7 to September 11, Mr. Edward R. Barton and Mr. F. D. Luddington were employed to assist in inspecting nurseries.

All members of the staff have rendered efficient and faithful services.

INSPECTION OF NURSERIES.

Mr. Zappe was placed in charge of this work and began on August 5. There was much rainy weather and the spraying and dusting experiments required that the dropped fruit be scored, as well as the picked fruit later. The work somewhat interfered with the inspection of nurseries. Nevertheless all was finished on October 18. Messrs. Zappe and Walden did most of this inspection work but were assisted at times by Messrs. Garman, Britton and Sealy, and Mr. F. D. Luddington and Mr. E. R. Barton were employed from August 7 to September 11, and helped inspect the larger nurseries. No one from the gipsy moth force was pressed into service inspecting nurseries, except that Mr. Ashworth helped the Entomologist inspect two nurseries in Windham County on September 2.

The same system of inspection in vogue in preceding years was continued in 1920, and most of the inspection trips were made in the department automobile.

In 46 nurseries no pests were found.

The principal pests, with the number of nurseries infested by each are as follows:

Insects:—Oyster-shell scale 38; San José scale 11; Scurfy scale 7; pine leaf scale 7; tulip tree scale 3; rose scale 2; spruce gall aphid 21; *Chermes cooleyi* 2; green apple aphid 2; woolly apple aphid 2; elm scale, euonymus scale, pine weevil, lilac borer, peach borer and Rhododendron lace bug, one each.

Plant Diseases:—Poplar canker 13; fire blight 6; crown gall 1.

On the whole about the same pests were found as last year though the oyster-shell scale and the San José scale were not present in as many nurseries, and 46 nurseries were found uninfested as against 32 last year.

Two new nurseries started in the spring and were inspected then and again inspected in the fall. These are marked (2) after the name on the list. Five nurseries have gone out of business, two have changed in name, and eight new ones have started during the year. Five old ones did not clean out the infested stock in time to obtain certificates and consequently were not on the list last year. Two nurseries have not cleaned out the infested stock, this year, and consequently have not received certificates.

Thirty-five separate parcels of nursery stock have been inspected and certificates granted.

The list for the season contains 90 names as follows:

NURSERY FIRMS IN CONNECTICUT RECEIVING CERTIFICATES IN 1920.

Name of Firm	Address.	Acreage.	Certificate Issued.	No. of Certificate.
arnes Bros. Nursery Co.	Yalesville	150	Sept. 23	1115
arnes Nursery & Orchard Co.	Wallingford	12	Aug. 30	1073
eattie, Wm. H.	New Haven	1	Sept. 13	1091
ertolf Bros.	Sound Beach	25	Sept. 18	1106
rainard Nursery & Seed Co.	Thompsonville	6	Sept. 15	1094
raley & Co.	Burnside	1	Sept. 17	1102
retschneider, A.	Danielson	1	Sept. 3	1081
ristol Nurseries, Inc.	Bristol	5	Oct. 13	1132
urr & Co., C. R.	Manchester, Ellington and Durham	500	Aug. 20	1075
urroughs, Thos. E.	Deep River	3	Oct. 5	1129
hapman, C. B.	Groton	1	Sept. 21	1110
hapman, C. E.	North Stonington	4	Sept. 16	1098
oari & Co.	Norwalk	2	Sept. 9	1085
onine Nursery Co.	Stratford	50	Oct. 8	1131
onley, L. D.	Ridgefield	8	Oct. 2	1124
onn. Agricultural College (Prof. S. P. Hollister)	Storrs	1	Aug. 7	1072
onn. Agr. Experiment Station (W. O. Filley, State Forester)	New Haven	1	Oct. 18	1140
rofut & Knapp Farm	Norwalk	20	Dec. 30	1159
ross Highway Nurseries	Westport	6	Nov. 27	1151
'allas, Inc., Alexander	Waterbury	1	Nov. 23	1149
'owd, F. C.	Madison	1	Sept. 22	1112
lm City Nursery Co., Woodmont Nurseries, Inc.	Woodmont and New Haven	155	Sept. 7	1082
vergreen Nursery Co.	South Wilton	1	Sept. 10	1088
airfield Landscape & Nurseries Co.	Cannondale	5	Dec. 31	1160
alcon's Flight Farms Nursery (B. Austin Cheney, Prop.)	Litchfield	1	Oct. 2	1123
ardner's Nurseries	Cromwell	5	Aug. 31	1078
eduldigs Greenhouses	Norwich	1	Nov. 5	1147
lenn Terrace Ornamental Nursery (James H. Everett, Prop.)	Mount Carmel	4	Oct. 29	1146
oodwin Associates, Inc., the James L.	Hartford	1	Sept. 29	1122

NURSERY FIRMS IN CONNECTICUT RECEIVING CERTIFICATES IN 1920—*Cont'd.*

Name of Firm.	Address.	Average.	Certificate Issued.	No. of Certificate.
Hartford Park Commissioners	Hartford	1	Dec. 31	1161
Heath & Co.	Manchester	5	Aug. 20	1077
Hilliard, H. J.	Sound View	1	Sept. 16	1100
Hiti Nurseries (J. H. Bowditch, Prop.)	Pomfret Center	8	Sept. 3	1080
Holcomb, Irving	Simsbury	1	Sept. 15	1092
Horan & Son, Jas.	Bridgeport	1	Sept. 9	1086
Houstons' Nurseries	Mansfield	4	Dec. 23	1157
Hoyt's Sons Co. Inc., The Stephen	New Canaan	300	Oct. 19	1141
Hunt & Co., W. W.	Hartford	10	Sept. 28	1119
Intravaia, Joseph	Middletown	1	Aug. 31	1079
Isselee, Charles	Darien	10	Nov. 30	1152
Kelley, James J.	New Canaan	1	Sept. 9	1084
Kellner, Herman H.	Danbury	1	Oct. 2	1126
Keso Nursery (J. J. Kelsey, Prop.)	Clinton	1	Sept. 22	1113
Ladd & Nichols, Inc.	Greenwich	2	Nov. 23	1150
Laddin's Rock Nursery (W. L. Marks, Prop.)	Stamford	5	Oct. 13	1133
Larkin Bros., The	New London	2	Sept. 15	1095
Long, Mrs. J. A.	East Haven	1	Oct. 23	1144
Mallett Co., George A.	Bridgeport	1	Oct. 28	1145
Maplewood Nurseries (T. A. Peabody, Mgr.)	Norwich	1	Sept. 16	1099
Marigold Farm (H. Kelley, Prop.)	New Canaan	2	Sept. 21	1111
Meier & Gillette	West Hartford	2	Oct. 16	1136
Millane Tree Expert Co.	Middletown	1	Sept. 15	1093
New Haven Nurseries	New Haven	10	Nov. 30	1153
New Haven Park Commissioners (G. X. Amrhyn, Supt.)	New Haven	30	Dec. 29	1158
New London Cemetery Association (Ernest E. Rogers, Pres.)	New London	1	Sept. 15	1096
New London County Nurseries (W. J. Schoonman, Prop.)	New London and Stonington	5	Dec. 3	1154
North-Eastern Forestry Co.	Cheshire	20	Sept. 9	1083
Oakland Nurseries	Manchester	5	Aug. 20	1076
Ouwerkerk & Van der Stam (2)	Yalesville	1	Oct. 16	1137
Palmer, Est. of L. M.	Stamford	5	Sept. 28	1120
Park Gardens	Bridgeport	1	Sept. 21	1107
Pequod Nursery Co.	Yalesville	15	Sept. 23	1116
Phelps, J. Wesson	Bolton	1	Sept. 17	1103
Phelps & V. T. Hammer Co., The J. W.	Branford	2	Dec. 13	1155
Pierson, A. N., Inc.	Cromwell	50	Sept. 11	1089
Polish Orphanage (Rev. L. Bojnowski, Mgr.)	New Britain	1	Oct. 13	1134
Pomeroy, Edwin C.	Northville	1	Oct. 2	1127
Quality Seed Store	Stamford	1	Oct. 5	1128
Reck, Julius	Bridgeport	1	Sept. 21	1109
Rockfall Nursery Co. (P. Marotta, Prop.)	Rockfall	2	Aug. 30	1074
Saxe & Floto	Waterbury	1	Oct. 16	1139
Scheepers, Inc., John (2)	Sound Beach	6	Sept. 28	1121
Schleichert, F. C.	Bridgeport	1	Sept. 21	1108
Scott, J. W.	Hartford	5	Nov. 11	1148
Seely, C. H.	Darien	1	Oct. 20	1142

NURSERY FIRMS IN CONNECTICUT RECEIVING CERTIFICATES IN 1920—*Cont'd.*

Name of Firm.	Address.	Average.	Certificate Issued.	No. of Certificate.
Sierman, C. H.	Hartford	5	Oct. 22	1143
South Wilton Nurseries	South Wilton	5	Sept. 10	1087
Stannard Hill Greenhouses (J. E. Brooks, Prop.)	Westbrook	1	Sept. 22	1114
Steck, Charles A.	Bethel	2	Oct. 2	1125
Stratfield Nursery Co.	Bridgeport	4	Dec. 21	1156
Traendly & Schenck	Rowayton	2	Sept. 24	1117
Upson, R. E.	Marion	1	Oct. 16	1135
VanWilgen & Co.	Branford	3	Sept. 18	1105
Verkades Nurseries	New London	8	Sept. 15	1097
Vidbourne & Co., J.	Hartford	7	Oct. 7	1130
Wallace, Arthur T.	Wallingford	2	Oct. 16	1138
Wild, Henry	Riverside	1	Sept. 27	1118
Wilson & Co., C. E.	Manchester	10	Sept. 17	1101
Yale University Forest School	New Haven	1	Sept. 13	1090
Young, Mrs. Nellie A.	Pine Orchard	1	Sept. 18	1104
Total acreage		1,553		

INSPECTION OF IMPORTED NURSERY STOCK.

The establishment of Federal Quarantine, No. 37, which became effective June 30, 1919, has greatly reduced the quantity of nursery stock entering Connecticut from foreign countries. In fact it has prohibited general importation and the only kind now entering the state directly and needing inspection by state inspectors is stock for propagating purposes. This is nearly all Manetti rose stock, which is consigned to the larger florists' establishments, and fruit seedlings purchased by the larger nurseries that grow fruit trees. As these plants are small, a large number of them can be packed in a case of ordinary size. As only a few firms import such stock, the number of shipments received was much smaller than in preceding years, but the number of plants was in much greater proportion, as the following figures for 1919 and 1920 will show:

Year.	No. of Shipments.	No. of Cases.	No. of Plants.
1919	131	1,075	1,164,701
1920	17	87	814,491

Most of this stock was inspected by Messrs. Zappe, Chamberlain and Walden, and the time required amounts to 133 hours, or 17.7 days of seven and one-half hours each, or .68 months of 26 working days each. The cost according to the office accounts amounted to $825.83, including time of men and traveling expenses, and was paid out of the state appropriation for suppressing gipsy and brown-tail moths and inspecting nursery stock.

The sources of this imported nursery stock were as follows:—

SOURCES OF IMPORTED NURSERY STOCK, 1919-1920.

Country.	No. of Shipments.	No. of Cases.	No. of Plants.
France	8	31	359,300
Holland	4	20	152,691
England	4	28	290,000
Scotland	1	8	12,500
Total	17	87	814,491

The following table shows quantity of stock as inspected by months:—

Month.	No. of Shipments.	No. of Cases.	No. of Plants.
January	1	2	15,500
February	4	15	111,700
March	4	16	208,100
April	7	52	467,500
May	1	2	11,691
Total	17	87	814,491

Of the 17 shipments, 11 shipments or 64.8 per cent. were found to be infested with insects or plant diseases, some of which are pests.

Last year many imported bulbs were inspected, but this is now all done by Federal inspectors at the ports of entry.

Details regarding the infestations on imported nursery stock are as follows:—

PESTS FOUND ON IMPORTED NURSERY STOCK.

11 Shipments Infested.

Insects, etc.

Bulb Mite on Manetti rose. (1 shipment) Thos. Smith & Son, Stranraer, Scotland.

Emphytus cinctus Linn. on Rose. (7 shipments) R. H. Both, Wisbech, England. Franco-American Seedling Co., Angers, France. Thos. Smith & Son, Stranraer, Scotland. Levasseur & Fils, Ussy, France. S. Bide & Sons, Ltd., Farnham, Surrey, England. W. Fromow & Sons, Windlesham Surrey, England. As. Ouwerkerk, Boskoop, Holland.

Lepidopterous cocoons. (2 shipments) Kings Acre Nurseries, Henford, England. S. Bide & Sons, Ltd., Farnham, Surrey, England. Larva. (1 shipment) Felix & Dykhuis, Boskoop, Holland.

Sow bugs. (1 shipment) Levasseur & Fils, Ussy, France.

Spider. (2 shipments) Levasseur & Fils, Ussy, France. S. Bide & Sons, Ltd., Farnham, Surrey, England.

Staphalinid beetle on rose. (2 shipments) Thos. Smith & Son, Stranraer, Scotland. Felix & Dykhuis, Boskoop, Holland.

Vespula germanica Fabr. (1 shipment) Franco-American Seedling Co., Angers, France.

Woolly aphis on apple. (1 shipment) Franco-American Seedling Co., Angers, France.

Plant Diseases.

Crown Gall on rose. (5 shipments) Vincent Lebreton's Nurseries, La Pyramide, France. Franco-American Seedling Co., Angers, France. Felix & Dykhuis, Boskoop, Holland. W. Fromow & Sons, Windlesham Surrey, England.

INSPECTION OF APIARIES.

There has been no change in the system of apiary inspection or in the personnel of the inspectors since last year. The new law passed by the last General Assembly requiring beekeepers to register with their town clerks was generally though not fully observed, and proved quite a help to the inspectors in locating apiaries.

Mr. H. W. Coley of Westport has continued to inspect in Fairfield, New Haven, Middlesex and New London counties, and Mr. A. W. Yates of Hartford likewise has continued to inspect in Litchfield, Hartford, Tolland and Windham counties, each working on a basis of six dollars per day and expenses.

Many colonies of bees did not survive the winter, and though more apiaries were inspected than in 1919, the number of colonies was considerably smaller.

During the summer of 1920, 762 apiaries, containing 4,797 colonies of bees, were inspected as against 723 apiaries and 6,070 colonies in 1919. In making these inspections, 119 towns were visited in 1920 and 102 towns in 1919.

Inspections have never been made in the towns of Union (Tolland County) and Eastford (Windham County).

The following ten towns were visited in inspection work in 1920 for the first time:

Fairfield County—Sherman and New Fairfield.
New Haven County—East Haven.
Middlesex County—Essex, Chester and Middlefield.
New London County—Lebanon, Preston and Voluntown.

Inspections were made in the following 38 towns not visited in 1919:

Fairfield County—Brookfield, New Fairfield, Sherman and Trumbull.
New Haven County—Bethany, East Haven North Haven and Woodbridge.
Middlesex County—Chester, Clinton, Cromwell, Essex, Haddam and Middlefield.
New London County—Bozrah, Colchester, Franklin, Griswold, Preston and Voluntown.
Litchfield County—Barkhamsted, Canaan, Colebrook, Cornwall, Goshen, Morris, New Hartford, Norfolk, North Canaan, Roxbury, Salisbury, Sharon and Winchester.
Hartford County—Hartland and Simsbury.
Tolland County—Columbia, Ellington and Hebron.

On the other hand, inspections were made in 1919 in the following 29 towns, not visited in 1920:

Fairfield County—Bethel and Redding.
New Haven County—Oxford and Wolcott.
Middlesex County—East Hampton and Killingworth.
New London County—Groton, Old Lyme and Stonington.
Litchfield County—Bethlehem, Plymouth and Warren.

Hartford County—Avon, Canton, Manchester, Windsor and Windsor Locks.
Tolland County—Stafford, Tolland and Willington.
Windham County—Brooklyn, Killingly, Plainfield, Pomfret, Putnam, Scotland, Sterling, Thompson and Woodstock.

The percentage of apiaries infested with European foul brood has decreased each year since the inspection service was established. In 1920 it was only 4.3 per cent. as against 6.6 in 1919. The percentage of colonies, however, was 1.5 per cent. in 1920, slightly larger than the 1.2 per cent. found infested in 1919. This is due, not to any increase in the disease as the percentages of infested apiaries show, but to the smaller number of colonies in the average apiary, which is only 6.5 in 1920, as against 11.2 in 1919, on account of so many bees dying in the winter. During 1920, the European foul brood was found in the following 22 towns:

Fairfield County—Darien, Fairfield and Sherman.
New Haven County—North Haven, Prospect and Wallingford.
Middlesex County—Essex, Durham and Haddam.
New London County—Waterford.
Litchfield County—Barkhamsted, Bridgewater, Thomaston, Washington, Watertown and Winchester.
Hartford County—Glastonbury, Hartland, Marlborough and Southington.
Tolland County—Ellington and Mansfield.

American foul brood was found in nine apiaries and in five towns and was much less prevalent than in 1919, when it occurred in 22 apiaries in eight towns. In 1920, this disease was found in Wallingford (New Haven County), Durham (Middlesex County), East Lyme (New London County), Winchester (Litchfield County), and Wethersfield (Hartford County). Wallingford and East Lyme were infested in 1919.

The percentage of apiaries infested with American foul brood in 1920 is 1.18 and of colonies .25, as against 3.00 per cent. and 1.1 per cent. respectively in 1919.

The statistics of the apiaries inspected in 1920 in each of the 119 towns visited, are arranged by counties in the following pages and summarized on page 149:

APIARIES INSPECTED IN 1920.

	No. Apiaries Inspected.	No. Apiaries Diseased.	No. Colonies Inspected.	No. Colonies Diseased.
Fairfield County:				
Bridgeport	2	1	55	2‡
Brookfield	6	1	54	1‡
Danbury	18	0	163	0
Darien	3	1	28	1†

* American Foul Brood.
† European Foul Brood.
‡ Sacbrood.

	No. Apiaries Inspected.	No. Apiaries Diseased.	No. Colonies Inspected.	No. Colonies Diseased.
Easton	1	0	56	0
Fairfield	8	2	93	2‖†
Greenwich	7	0	102	0
Monroe	4	0	44	0
New Canaan	2	0	22	0
New Fairfield	4	0	34	0
Norwalk	7	0	66	0
Ridgefield	3	0	11	0
Shelton	2	0	24	0
Sherman	10	2	80	2†
Stamford	7	0	40	0
Stratford	3	0	33	0
Trumbull	2	0	14	0
Weston	2	0	2	0
Westport	8	0	76	0
Wilton	16	0	159	0
	115	7	1156	8
New Haven County:				
Beacon Falls	1	0	0	0
Bethany	3	0	7	0
Branford	4	1	45	1‡
Cheshire	2	0	26	0
Derby	4	0	31	0
East Haven	4	0	17	0
Guilford	3	0	18	0
Hamden	12	0	46	0
Madison	2	0	3	0
Meriden	26	0	155	0
Middlebury	2	0	14	0
Milford	3	0	32	0
Naugatuck	6	0	32	0
New Haven	3	0	10	0
North Haven	2	1	31	1†
Prospect	4	1	29	3†
Seymour	1	0	11	0
Wallingford°	17	7	106	9°
Waterbury	8	0	34	0
Woodbridge	4	0	16	0
	111	10	663	14
Middlesex County:				
Chester	4	0	15	0
Clinton§	1	0	0	0
Cromwell	7	1	26	1‡
Durham	6	3	65	4**
East Haddam	2	0	5	0

* American Foul Brood.
† European Foul Brood.
‡ Sacbrood.
‖ Paralysis.
° 3 apiaries with 1 A. F. B. each, 3 with 1 E. F. B. each, 1 with 2 A. F. B. and 1 E. F. B.
** 1 A. F. B., 1 E. F. B. and 2 Sacbrood.

	No. Apiaries Inspected.	No. Apiaries Diseased.	No. Colonies Inspected.	No. Colonies Diseased.
Essex	4	2	16	2†
Haddam	3	1	16	2†
Middlefield	5	0	30	0
Middletown	19	0	85	0
Old Saybrook	2	0	7	0
Saybrook	6	0	24	0
Westbrook	2	0	8	0
	61	7	297	9
New London County:				
Bozrah	4	1	40	1‡
Colchester	14	1	30	1‡
East Lyme	4	1	15	1*
Franklin	1	0	6	0
Griswold§	4	0	1	0
Lebanon	4	1	10	1‡
Lisbon	3	0	7	0
Montville	7	0	18	0
New London	1	0	10	0
Norwich	6	0	369	0
Preston	5	1	19	1‡
Voluntown‖	4	0	2	0
Waterford	3	1	18	4†
	60	6	545	9
Litchfield County:				
Barkhamsted	4	2	74	5†
Bridgewater	7	2	37	3†
Canaan	6	0	29	0
Colebrook	1	0	10	0
Cornwall	2	0	2	0
Goshen	4	0	20	0
Harwinton	1	0	3	0
Litchfield	7	0	27	0
Morris	6	0	27	0
New Hartford	5	0	24	0
New Milford	14	0	101	0
Norfolk	5	0	10	0
North Canaan	10	0	88	0
Roxbury	5	0	22	0
Salisbury	6	0	42	0
Sharon	8	0	66	0
Thomaston	6	1	38	3†
Torrington	6	1	84	1‖
Washington	10	1	86	2†
Watertown	13	2	70	3†
Winchester	19	5	54	8§
	145	14	914	25

* American Foul Brood.
† European Foul Brood.
‡ Sacbrood.
‖ All bees killed in 3 aparies.
§ 4 A. F. B. and 4 E. F. B.

	No. Apiaries Inspected.	No. Apiaries Diseased.	No. Colonies Inspected.	No. Colonies Diseased.
Hartford County:				
Berlin	18	0	136	0
Bloomfield	11	0	85	0
Bristol§	1	0	0	0
Burlington	1	0	5	0
East Granby	6	0	28	0
East Hartford	15	0	58	0
East Windsor	9	0	97	0
Enfield	3	0	22	0
Farmington	22	0	49	0
Glastonbury	17	1	55	2†
Granby	4	0	47	0
Hartford	26	0	92	0
Hartland	2	1	4	2†
Marlborough	2	1	22	3†
New Britain	17	0	69	0
Newington	10	0	51	0
Plainville	5	0	35	0
Rocky Hill	8	0	10	0
Simsbury	3	0	6	0
Southington	12	2	65	7†
South Windsor	8	0	22	0
Suffield	1	0	7	0
West Hartford	24	0	57	0
Wethersfield	13	1	44	1*
	238	6	1066	15
Tolland County:				
Andover	1	0	1	0
Bolton	1	0	4	0
Columbia	3	0	10	0
Coventry	2	0	10	0
Ellington	13	1	49	1†
Hebron	3	0	6	0
Mansfield	3	2	36	16†
Vernon	5	0	36	0
	31	3	152	17
Windham County:				
Windham	1	0	4	0

SUMMARY.

County.	No. of Towns.	No. Apiaries Inspected.	No. Apiaries Diseased.	No. Colonies Inspected.	No. Colonies Diseased.
Fairfield	20	115	7	1156	8
New Haven	20	111	10	663	14
Middlesex	12	61	7	297	9
New London	13	60	6	545	9
Litchfield	21	145	14	914	25
Hartford	24	238	6	1066	15
Tolland	8	31	3	152	17
Windham	1	1	0	4	0
	119	762	53	4797	97

* American Foul Brood.
† European Foul Brood.
§ 6 colonies winter killed.

	No. Apiaries	No. Colonies
Inspected	762	4,797
Infested with European foul brood	33	72
Per cent. infested	4.3	1.5
Infested with American foul brood	9	12
Per cent. infested	1.18	.25
Sacbrood	9	11
Bee Paralysis	2	2
Average number of colonies per apiary		6.5
Cost of inspection		$1,954.55
Average cost per apiary		$2.565
Average cost per colony		.41

REPORT OF WORK IN SUPPRESSING THE GIPSY AND BROWN-TAIL MOTHS.

Season of 1919-1920.

BY W. E. BRITTON, IRVING W. DAVIS AND JOHN T. ASHWORTH.*

The plan and methods developed in preceding years has been followed with satisfactory results. Full and hearty co-operation between the Federal Bureau of Entomology and the state forces has resulted beneficially to both parties. Most effort has been directed against the gipsy moth as the brown-tail moth has not been abundant for several years. The gipsy moth has been held well in check and except in the towns of Thompson, Woodstock, Killingly, Brooklyn and Griswold, the number of infestations has been smaller than last year.

The gipsy moth work was considerably handicapped on account of labor and weather conditions. The former was mainly a lack of experienced men. New men were taken on the work, but before they had become at all proficient would leave for more remunerative positions. August was the beginning of a rainy spell which virtually lasted until the heavy snows came in February. The depth of the snow caused so much delay, that twelve pairs of snow-shoes were purchased and did excellent service while the snow lasted.

No new towns were found infested and no trace of the gipsy moth was found in seven of the towns that were infested a few years ago. These towns are as follows: Ashford, Mansfield, Windham, Scotland, Franklin, Sprague and Stonington.

As in the last two years, in the older infested towns, single egg-clusters were not counted as infestations. In the border towns and in the towns not previously known to be infested, single egg-clusters have been reckoned as infestations.

No special work was done against the brown-tail moth this winter, but during scouting for the gipsy moth the men kept a sharp lookout for brown-tail webs, but none were found.

NEW EQUIPMENT.

In 1918 a truck body was mounted on a Ford chassis, as was noted in the report for that year and this proved so satisfactory that during the summer of 1919 two new Fords with delivery bodies were purchased. These have given excellent service during

*Note.—Mr. Davis who has been in charge of this field work for nearly seven years, resigned June 10, 1920, to accept a position with the Danielson Trust Company of Danielson. Mr. Ashworth who has been employed under Mr. Davis for nearly three years is now in charge of the field work. The details of the work in each town, table of statistics and new equipment have been prepared by Messrs. Davis and Ashworth, and I have written the introduction, the chapter on parasites and prepared the financial statements and recommendations, etc.—W. E. Britton.

the year past. The second-hand Buick car which was purchased in 1918 gave us considerable trouble, and in January, 1920, it was sold and a new Ford touring car purchased to replace it. This has been very satisfactory.

Each year we have had to borrow one or more spraying machines from the Federal Government. This year it seemed advisable for the State to purchase apparatus, and a new automobile truck power sprayer was obtained similar to the one purchased in 1918 (for description see Report for 1918, page 273). As the price of spraying hose had advanced so much it was not thought wise to purchase more than twelve hundred feet of 1-in. hose and 50 feet of 2½-in. suction hose. (This hose has not proved satisfactory and much of it will have to be replaced.)

By the middle of February the snow was so deep that it was useless to continue scouting. An effort was made to borrow some snow-shoes for experiment, but as these could not be obtained, twelve pairs were purchased and during the rest of the winter were used with a great saving of time and effort.

Labor and Board.

At the close of the war practically all of the men who left this work to enter the service returned to it as soon as discharged. These men were all experienced and made a valuable addition to the force. With the trades advancing wages in all lines many of the men left to obtain higher wages elsewhere. This was particularly true of the new men who received the minimum wage, in the graduated wage-scale now in force. This shortage of men was felt keenly, especially as the winter came on for it proved to be the most severe of any winter we have had since this work started. With the aid of the Government forces, however, the scouting was completed, although it had to be continued so late that there was little time for the work of banding the trees.

Obtaining board continued to be one of the handicaps to the work. Such high wages were paid, that people who had formerly taken boarders found more money and shorter hours in the mills. It was therefore almost impossible to obtain board and when obtained, the price was so high as to be prohibitive to the men at the wages they were receiving. The men were therefore transported from the towns where they lived (in most cases Killingly) and brought back at night. For this purpose the Ford delivery trucks were a necessity, and have been used continuously since they were purchased.

Financial Statement.

Appropriation for biennial period ending June 30, 1921	$70,000.00
Expended year ending June 30, 1920	33,081.11
Balance for current year	$36,918.89

CLASSIFIED EXPENDITURES FOR THE YEAR ENDING JUNE 30, 1920.

Salaries and Wages:		
I. W. Davis	$1,766.62	
J. T. Ashworth	1,435.00	
J. A. McEvoy	1,241.92	
K. E. Buffington	1,198.80	
C. A. Burdick	1,218.32	
F. C. Rich	1,222.84	
J. Knight	400.88	
W. P. Colvin	1,073.25	
C. W. Roth	472.23	
A. J. Gilbert	1,019.33	
R. F. Franklin	856.60	
C. Ladd	454.44	
D. La Belle	858.82	
J. W. Longo	979.91	
R. G. Newton	798.70	
P. H. Shea	1,000.36	
T. Perreault	651.66	
G. D. Stone	620.32	
A. J. Duprey	541.51	
Other labor	2,534.46	
		$20,345.97
Printing and Illustrations		29.91
Postage		18.24
Stationery		12.28
Telegraph and Telephone		54.66
Office Supplies		71.05
Express, Freight and Cartage		10.92
Machinery, Tools and Supplies		8,433.69
Insurance		608.49
Rental and Storage		220.77
Traveling Expenses, Gasoline, etc.		1,262.19
Automobile Tires and Repairs		1,120.54
Inspection of Imported Nursery Stock		825.83
Heat and Light		58.57
Miscellaneous		8.00
Total		$33,081.11

Details of Gipsy Moth Work by Towns

The following pages give a detailed account of the gipsy moth work in each of the towns infested:

Thompson—134 Infestations—4,342 Egg-clusters.

As was true of the scouting in many of the towns this past winter, the work in Thompson was greatly handicapped by the heavy snows and stormy weather. The work was finished about the last of March, and resulted in finding one hundred and thirty-four infestations containing four thousand three hundred and forty-two egg-clusters.

These colonies were spread over the entire town, but were a little more scattered in the western part than in the central and eastern portions. Where so many colonies are present it is diffi-

cult to indicate which are the most serious, but some of the larger may be mentioned.

One on land of Warren Logee about a mile from Brandy Hill, contained three hundred and twenty egg-clusters. These were found on three trees and a nearby stone wall.

A colony in woodland owned by Mrs. J. M. Robinson was found to contain one hundred and eighty-nine egg-clusters, and the examination of an infested stone wall about two miles further north resulted in the finding of two hundred and eighteen more.

In the western part of the town the largest colony was in pasture land owned by Mr. Fred Parker and situated near Fabyan. At this colony the one hundred and ninety egg-clusters were found in a stone wall and four oak trees.

Some tanglefoot was applied in this town, but as it was one of the last to be banded, larvae were observed before the work was quite completed.

During June, eighty-nine of the largest colonies and those most exposed to wind-spread, were sprayed with one of the truck sprayers, and after the spraying season was over, scouts were sent out to visit and inspect all colonies in the town and note the results from spraying; one thousand eighty-two larvae were found and destroyed.

Woodstock—41 Infestations—882 Egg-clusters.

Woodstock, besides being one of the largest towns in Connecticut, has a large road mileage. Many of these roads are old and have been discontinued for several years so that they are no longer passable, but in the gipsy moth work we have always considered them as thoroughfares and scouted them accordingly. From this fact it will be seen that the area of Woodstock is well covered in each years' scouting. This year proved no exception as this was the first town scouted and the work was largely done by the older men. As soon as it was deemed practicable all of the older men who could be spared were sent to work in the western part of Woodstock, and new men were added as fast as they were trained. One crew was withdrawn in the middle of October for work in Canterbury, and another the first of November to scout Eastford.

The rainy weather during the autumn months caused many delays in the work both from the actual time lost and from the poor roads. The scouting was completed on the twenty-eighth day of November, and resulted in finding forty-one colonies of the gipsy moth. These colonies were mostly found in the northeast and southwest portions of the town, with scattering ones in the southeast corner, while the northwest portion was very free from this pest. The majority of these colonies contained less than twenty egg-clusters, while the largest colony contained two hundred and twenty-eight. The latter was a woodland colony and found on land of Mr. Shead near the Thompson line. While this colony

was scattered over several acres, the timber was cut late in the fall and no further work was deemed necessary this winter.

Other large colonies were on land of Samuel Ide in the northerly part of the town, on land owned by Sidney P. Butler and Irving Perry in West Woodstock, and that on land of Charles Clark near Eastford.

At sixteen of the forty-one colonies, tanglefoot bands were placed around the trees as they were on land that was open and high, and therefore gave a good chance for wind-spread.

Thirty-one of the larger colonies were sprayed during the season using about 425 pounds of arsenate of lead. In all three hundred and twenty-five larvae were found and destroyed; only six, however, were found alive after spraying, four of which were found at infestation No. 35, where one hundred and twenty-five dead larvae were found at the same time.

UNION—1 Infestation—1 Egg-cluster.

Union was scouted by the state men this year, and as there was but little time remaining before the eggs would hatch, only the eastern portion of the town was covered. One egg-cluster was found, and that on a small oak near the Massachusetts line. The nearby growth was carefully scouted, but no other evidences of the pest were found. No spraying was done, but the territory around the infestation was watched during the larval season and nothing found.

PUTNAM—15 Infestations—482 Egg-clusters.

There was a notable decrease in the gipsy moth colonies in this town this past year. Only fifteen colonies containing four hundred and eighty-two egg-clusters were located, and the most of these lay to the west of the city of Putnam.

The largest colonies were found in woodland during the early fall and contained nearly half of the egg-clusters found in the town. These, two in number, were both in the eastern part of the town and covered a large area; in one case, forty trees being infested and in the other ninety-four. The danger of spread from these infestations is very small, as they are located so that they are not exposed to the wind.

A group of four colonies found on the hill to the east of the Grove Street cemetery are in an exposed location. While these colonies contained only forty-eight egg-clusters in all, they will need careful attention because the growth on this hill is rather light and therefore is badly wind-swept.

Several of these colonies were banded with tanglefoot during May, and in June ten of the fifteen colonies were sprayed. In looking over the colonies during the latter part of July and the first of August, one thousand six hundred sixteen larvae were found and destroyed, over half of them being just outside in-

festation No. 14, along a stone-wall containing a number of egg-clusters which were covered with snow when the country was scouted last winter.

POMFRET—22 Infestations—274 Egg-clusters.

The western half of this town was scouted just before the heavy snows of last winter. These storms caused the work in this town to be stopped about the first of February. It was later resumed, however, and the town finished the last part of April.

Only twenty-two infestations were found and these may be roughly divided into three groups, one in each of the three corners of the town, while the fourth, the northeast, contained but one colony.

The colonies were all small, considering that Pomfret has been infested for seven years, the largest having only thirty-six egg-clusters. In several of the colonies the trees were banded with tanglefoot and following that were examined for larvae prior to spraying.

In June, eleven of the largest colonies were sprayed with arsenate of lead, and after the spraying season was over all colonies were inspected to determine the results obtained, and in all colonies sprayed and not sprayed a total of only six hundred sixty larvae were found and destroyed.

EASTFORD—10 Infestations—178 Egg-clusters.

A glance at the map of Connecticut will show the peculiar shape of the town of Eastford. A long narrow portion, bounded by Ashford, Union and Woodstock, extends northward, while the southern part is broader and more rectangular in shape. In this northern portion was located only one of the one hundred and seventy-eight egg-clusters found in this town. The majority of both colonies and egg-clusters were found in a group to the north and northeast of Phoenixville.

All of the gipsy moth colonies found in Eastford were in either pasture or woodland. None were considered serious, and the largest colony contained only forty egg-clusters. This was in some woodland owned by Mr. Charles Wheaton and situated to the east of the road which leads past Crystal Lake.

Several of the colonies were banded early in May, and nine of the ten were sprayed during the month of June, three thousand gallons of spray mixture being used. In checking up the results after spraying, the men were unable to find a single larva at any of the colonies, although six hundred fifteen were destroyed before spraying.

KILLINGLY—46 Infestations—1,579 Egg-clusters.

Late in the summer of 1919, considerable woodland scouting was done in Killingly, and three infestations were located on the

ridge about a mile east of the Borough of Danielson. This woodland was cut over during the winter and it is doubtful if it would pay to spray it.

In the winter scouting, the entire town proved to be infested, the only locality which was free of colonies being in the southwest corner of the town. This is explained by the fact that this section is rather open, the growth being mostly scrub-oak and pine.

Two of the colonies are worth noting, both of which were found in the northeastern corner of the town. One of these contained three hundred and thirty and the other three hundred and twenty-nine egg-clusters. The former was on land owned by William Roberts and situated a little south of the Putnam line. The infested growth was three apple trees in a pasture, but was so located that the spraying could be done with a hand-sprayer.

The latter was at the northern end of Chestnut Hill on land belonging to Mrs. Roxy Bartlett. This is about a mile south of the former infestation "as the crow flies." The egg-clusters here were found mostly in a stone wall by the roadside, although an oak and apple tree were also infested.

During the latter part of May, six hundred and fourteen tanglefoot bands were applied to trees at twenty-nine of the infestations, following which thirty-eight of the forty-six infestations were sprayed, one truck sprayer and a small hand sprayer being used. Two thousand forty-five larvae were found and destroyed; of this number, only thirty-four were located after the colonies had been sprayed.

Brooklyn—20 Infestations—499 Egg-clusters.

When the snow became so deep in February, one of the scouting crews were sent into Brooklyn. As the scouts were all living in Danielson, the eastern part of the town was scouted first, most of the work being done on snow-shoes. After the snow had disappeared, many of the colonies were examined again for egg-clusters which might be found beneath the snow line.

The eastern section of the town contained most of the colonies, only one being found in the extreme western part. This one, however, was the largest found in Brooklyn, and contained one hundred and thirteen egg-clusters. This colony was on a high elevation in a wooded pasture owned by Joseph Stetson. As this was a wind-swept area, careful work was done to prevent spread from it.

Most of the other colonies were small, and not of great importance. Two colonies which contained seventy-six and one hundred and thirteen egg-clusters, respectively, were so situated that control measures were easily accomplished. The former was in an old apple tree which was cut down, and the latter was in a swamp to the west of Tatnic Hill, where spread by means of wind would be largely eliminated.

At twelve of the colonies, three hundred ninety-four bands of tanglefoot were put around the trees the early part of May, and in June fifteen were sprayed, two thousand three hundred gallons of spray mixture being used. A total of five living larvae were found at four of the colonies when the men looked them over during the latter part of July.

HAMPTON—5 Infestations—6 Egg-clusters.

Though the number of gipsy moth egg-clusters found in the various towns of this state has remained about the same as last year, in Hampton there has been a marked decrease. This year fewer infestations and fewer egg-clusters were found than in 1914, when the town was first found infested.

In three of the five colonies, the trees were banded with tanglefoot, and as there were so few egg-clusters, spraying was not considered necessary.

CHAPLIN—1 Infestation—3 Egg-clusters.

Only one infestation of gipsy moths was found in Chaplin during the past season's scouting. This was a small colony and was found in an orchard on land owned by Mr. Murphy near the northeastern part of the town. The trees were banded with tanglefoot during the latter part of May. It was not thought necessary to spray this colony. A close watch was kept but no larvae were found.

STERLING—9 Infestations—177 Egg-clusters.

The Moosup River flowing to the west from Rhode Island divides Sterling into a north and south portion of very nearly equal areas. All of the colonies of the gipsy moth found in Sterling this year were to the north of this river. None of these colonies contained a very large number of egg-clusters, the largest colony being that found on land of Mr. G. R. Brown, which totaled fifty-eight. This was located in an apple tree by the roadside and adjacent stone wall. Another colony about a mile northwest of this one, was that on land of John Dixon. This was on a hill which has an elevation of six hundred forty feet, and as that is rather high for that locality, the danger from wind-spread is great.

The trees in most of the colonies in Sterling were banded with tanglefoot early in May. All but one of the colonies in Sterling were sprayed, that being one on land of the Hillside Farm near North Sterling, twenty-two of the twenty-four egg-clusters being old ones, it was not thought advisable to spend the time that could be used to advantage elsewhere.

PLAINFIELD—10 Infestations—398 Egg-clusters.

This was one of the last towns scouted this year, and as the season was so far advanced only the southern portion of the town

was well covered. In the northern section, the scouting was done only around the infestations of the previous year.

The largest colony located was on the western slope of Black Hill in the western part of the town. This colony contained two hundred and eleven egg-clusters and was in some pasture apple trees. While this infestation is in a wind-swept locality it is rather easy to control, as there is but little growth near it. The few trees which are there were banded with tanglefoot early in May.

Another colony of importance was found on what is known as the Green Hollow road near the Killingly Line. This was found in a group of pasture oaks on land owned by Mr. Charles A. Tillinghast, and contained sixty-one egg-clusters. In several of the most open and wind-swept colonies, the trees were tanglefooted and later all of them were sprayed, the hand sprayer being used at two of the colonies; very few larvae were found after spraying and a large portion of them were dead.

Canterbury—9 Infestations—126 Egg-clusters.

One of the crews started scouting in Canterbury about the middle of October and finished the first of December. This was more time than it was planned to spend in this town, but the delay was largely due to the excessive rains.

Nine infestations were the result of this scouting, and these were scattered throughout the town. They contained a total of one hundred and twenty-six egg-clusters, about half of which were a year old. The colonies were all rather small, the largest containing thirty egg-clusters. This colony was found in an old orchard in the northern part of the town near the village of Wauregan.

The most serious infestation was probably one located near the Brooklyn line on land owned by Mr. Kerr. This consisted of twenty-three egg-clusters and was found in some oaks on a rather high elevation about half a mile from the nearest traveled road. During the month of May the trees in six of the infestations in this town were banded with tanglefoot.

Eight of the nine infestations were sprayed in June, one thousand eight hundred gallons of solution being used. It was not thought advisable to spray infestation No. 6, as there was only one new egg-cluster found. Three hundred and twenty-four larvae were found and destroyed during the season.

Voluntown—2 Infestations—2 Egg-clusters.

During the past winter, only two egg-clusters of the gipsy moth were found in this town, and both of these were in the northern part, but about three miles apart. These were not considered serious enough to warrant further work.

GRISWOLD—11 Infestations—33 Egg-clusters.

The colonies of the gipsy moth found in Griswold were all small, the largest containing only ten egg-clusters. All but two of these were found to the north of the Griswold Post Office. In the most serious of these colonies the trees were banded early in May.

Three colonies in Griswold were sprayed, four hundred and seventy-five gallons of solution being used. No larvae were found at the colonies during the season.

LISBON—1 Infestation—1 Egg-cluster.

The Federal men scouted Lisbon during the past winter and found but a single egg-cluster. This occurred in the western part of the town near the Sprague line. It was not thought serious enough to warrant the banding of the trees with tanglefoot and no spraying was done.

PRESTON—6 Infestations—127 Egg-clusters.

Though one hundred and twenty-seven gipsy moth egg-clusters were found in Preston during the past winter, one hundred and twenty-two of them were in two colonies. These two colonies were close together and a little to the north of the state road leading from Norwich to Preston City.

One of these infestations was located on land of Frank Ayer and contained one hundred and ten egg-clusters. This was in open woodland on some large oaks, but on rather low ground and from which there is little danger of wind-spread.

The other large colony was in an orchard belonging to Steve Stanewiez. There were but few trees found infested, but all of the trees in the orchard have cavities in them which make control measures difficult.

At four of the colonies the trees were banded with tanglefoot in May, and in the early part of June the two above-mentioned infestations were sprayed.

NORWICH—5 Infestations—74 Egg-clusters.

The result of the winters' scouting in the town of Norwich was the discovery of five colonies. Three of these contained but a single egg-cluster each and all of this group were located in the northeastern part of the town. The largest colony of forty-two egg-clusters was just inside the city limits, in the south part of the city. These were in an oak tree and stone wall, but there was very little growth near it. The most serious colony was in the western part of the town near the Bozrah line on the top of Wawecus Hill, which has an elevation of over four hundred feet. The colony is in roadside maples and apple trees and therefore is badly wind-swept

which may cause spread. The trees in this vicinity were banded early in May with tree tanglefoot, and were watched during the summer but no larvae found.

In the early part of June two of the colonies were sprayed.

BOZRAH—1 Infestation—4 Egg-clusters.

Only one infestation was found in Bozrah and that on land owned by Mr. R. A. Bethan and located near the Norwich line. The trees in this colony were banded during the month of May, and sprayed in June.

NORTH STONINGTON—1 Infestation—29 Egg-clusters.

Although only one infestation is listed as being found within the limits of this town, there were several single egg-clusters which were not counted as infestations. These were found well scattered throughout the town. The infestation noted was found close to the Hopkinton, R. I., line on land owned by Mr. Thomas Wheeler and the trees in this vicinity were banded early in the month of May. This infestation was sprayed on June 9th and during July most of singles were inspected at the same time as the above-described infestation and thirty-six larvae were found and destroyed; twenty-six of these larvae were at a single egg-cluster infestation situated near the Stonington line.

LEDYARD—3 Infestations—4 Egg-clusters.

All of the gipsy moth colonies found in Ledyard were in apple orchards, and all were small, there being only four egg-clusters found in the entire town. The trees near two of these infestations were banded with tanglefoot, and one was sprayed in June.

GROTON—1 Infestation—1 Egg-cluster.

Only one egg-cluster was found in Groton, and this was in the extreme northern part of the town. Aside from the creosoting of the egg-cluster no other work was considered necessary.

The statistics of this work as applies to each town and given in the preceding pages are summarized in the following table:

STATISTICS OF INFESTATION.

Town.	Infestations.	Egg-clusters.	Tanglefoot Bands.	Sprayed.	Larvae.
Thompson	134	4,342	216	89	1,082
Woodstock	41	882	83	31	328
Putnam	15	482	264	10	1,616
Pomfret	22	274	53	11	660
Eastford	10	178	20	9	615
Ashford	0	0	0	0	0
Killingly	46	1,579	614	38	2,045
Brooklyn	20	499	394	15	251

STATISTICS OF INFESTATION—*Cont'd.*

Town.	Infestations.	Egg-clusters.	Tanglefoot Bands.	Sprayed.	Larvae.
Hampton	5	6	35	0	0
Chaplin	1	3	10	0	0
Sterling	6	177	133	5	17
Plainfield	10	398	78	10	614
Canterbury	9	126	129	8	324
Scotland	0	0	0	0	0
Mansfield	0	0	0	0	0
Voluntown	0	0	0	0	0
Griswold	11	33	81	3	0
Lisbon	1	1	0	0	0
Sprague	0	0	0	0	0
North Stonington	2	29	24	1	36
Stonington	0	0	0	0	0
Groton	1	1	0	0	0
Union	1	1	0	0	0
Windham	0	0	0	0	0
Preston	6	127	51	2	24
Norwich	5	74	111	2	0
Ledyard	3	8	13	1	0
Bozrah	1	4	5	1	0
Franklin	0	0	0	0	0
21 Towns Infested	350	9,224	2,314	236	7,612

PARASITES.

In preceding years, an attempt has been made each year to liberate one or more species of the different parasites in some of the infested towns of the state, but owing to the weather and the labor conditions, we were unable to do it in 1920. However, collections of gipsy moth larvae were made in Thompson, Woodstock, Putnam, Pomfret, Killingly, Plainfield, Canterbury and Brooklyn, and sent to the Government laboratory at Melrose Highlands, Mass., in order to determine if any species of parasites could be recovered as a result of planting colonies. We are indebted to Mr. A. F. Burgess for much of the information regarding the planting and recovery of parasites, a full report up to that time being included in the Report of this Station for 1917, page 250. The following resumé brings the subject up to date, so far as Connecticut is concerned.

Calosoma sycophanta Linn.

Though not a parasite, both adults and larvae of this large ground beetle devour the caterpillars of the gipsy moth and it is therefore quite an important agency for holding that species in check. It was liberated in Stonington in 1914, in Thompson in 1915, and in Killingly in 1917. This species now seems to be fairly well distributed over the state, as it has been collected or observed in Thompson, Putnam, Killingly, Scotland, Plainfield, Groton, Lyme, Clinton, New Haven, Meriden and Darien. Our employees have reported observing these beetles feeding upon gipsy moth larvae in Thompson and Killingly in 1920.

Anastatus bifasciatus Fonsc.

This very minute Hymenopterous egg parasite was first liberated in Connecticut in 1917, when colonies were placed in Thompson, Woodstock, Putnam, Killingly, Pomfret, Eastford, Brooklyn, Hampton, Chaplin, Mansfield and Canterbury. More colonies were planted in Brooklyn in 1918, Canterbury 1919, Eastford 1918 and 1919, Griswold in 1918, Hampton in 1918 and 1919, Killingly in 1918 and 1919, Ledyard in 1919, Mansfield in 1918, Norwich in 1919, Plainfield in 1918 and 1919, Pomfret in 1919, Putnam in 1918 and 1919, Scotland in 1918, Sterling in 1918 and 1919, Thompson in 1919, Voluntown in 1918 and 1919, and Woodstock in 1918.

This insect was recovered from Eastford in 1917, and from Voluntown in 1918.

Apanteles lacteicolor Vier.

This is a small Hymenopterous parasite of the brown-tail moth larvae. It has been colonized in Connecticut as follows: Putnam in 1912, Suffield, Hartford, Mansfield, Norwich, Stonington, Griswold, Plainfield, Killingly and Hampton in 1913, Manchester Chester, Colchester and Lebanon in 1915, East Lyme and Canterbury in 1916, Montville and Groton in 1917.

This species has been recovered as follows: Brooklyn 1916, Canterbury 1917, East Hartford 1916, Groton 1918, Hartford 1913 and 1914, Killingly 1916, Lebanon 1915, Pomfret 1913, Putnam 1917, Stafford 1917, Stonington 1915, Suffield 1915, Thompson 1913 and 1916, Waterford 1914, 1916 and 1917, Wethersfield 1916, Woodstock 1913, 1915 and 1916.

Pteromalus egregius Forst.

A minute Hymenopterous parasite of the brown-tail caterpillars not colonized in Connecticut, but recovered from Hartford in 1913 and 1914, and Putnam in 1915.

Monodontomerus aereus Walker.

A minute Hymenopterous parasite of the pupae of both gipsy and brown-tail moths. Not colonized in Connecticut but recovered from Putnam in 1911 and 1915, Hartford and Suffield in 1912.

Meteorus versicolor Wesm.

This is a minute Hymenopterous parasite of the brown-tail caterpillars, and though no attempt was ever made to colonize the species in Connecticut, probably some cocoons were mixed with those of *Apanteles lacteicolor* and thus it became distributed. It was recovered from Hartford in 1914, and from Brooklyn, Killingly, Thompson, and Woodstock in 1916, and from Groton in 1918.

Compsilura concinnata Meigen.

This is a medium-sized Dipterous parasite or two-winged fly of the family Tachinidae attacking both the gipsy and brown-tail moths. It was colonized at Putnam in 1912, Hartford in 1913, Mansfield, Plainfield and Stonington in 1914, Stafford, Suffield, Colchester, Norwich and Old Lyme in 1915, and Hampton and Scotland in 1917. It has been recovered from Woodstock in 1915, Stonington in 1916, Putnam, Stafford, Plainfield and North Stonington in 1917, Pomfret, Putnam and Stonington in 1918, Killingly,

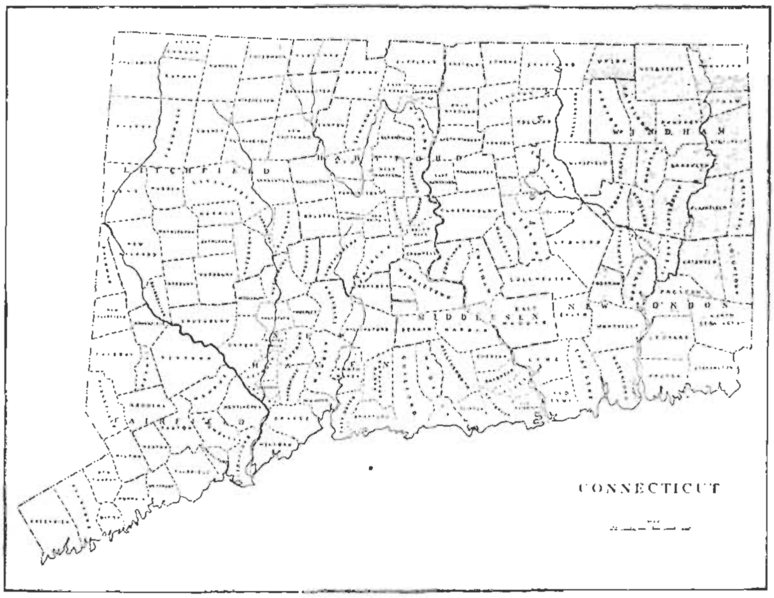

Figure 4. Map of Connecticut showing area quarantined on account of gipsy moth.

Plainfield, Pomfret, Putnam, Scotland and Thompson in 1919, and from Plainfield, North Stonington and Putnam in 1920.

Sturmia (*Zygobothria*) *nidicola* Townsend.

This is another Tachinid fly of medium size parasitizing the larvae of both gipsy and brown-tail moths, and though never colonized in Connecticut, it was recovered from Canterbury and Waterford in 1917, and from Groton and Stonington in 1918.

The foregoing records of parasites lead us to believe that most of these species have become fairly well distributed around the infested portion of the state even though not actually planted

there. Some help may therefore be expected from them in the years to come. The effectiveness of parasites depends much upon conditions, and is usually more pronounced in localities where the host is extremely abundant, and on account of the suppression work done, this has never been the case in Connecticut. Though parasites play an important part as a natural agency in controlling or holding in check a given species, they never exterminate their hosts. Of course, where conditions are like those in Connecticut, where their hosts are not very abundant and suppressive measures are being carried on, the parasites do not have the best kind of a chance. However, we are glad to know that they are still present.

Quarantine.

During 1919 eight Connecticut towns were removed from the Federal quarantined area as no traces of the gipsy moth had been found in them. This past winter three of these towns, Preston, Norwich and Bozrah, were again found to be infested and were added to the quarantined area.

The spread in the states of northern New England was very heavy and this gave rise to erroneous newspaper reports that there had been a great increase of the gipsy moth in Connecticut.

Only two towns, Groton and Stonington, were quarantined against the brown-tail moth, and as there were no webs of this insect found in this state last winter, it is doubtful if they are quarantined this year.

Under the Federal regulations, shipments going from the infested area to another state were inspected by the Federal agents, but shipments to another point within the state were not subject to inspection. This left the greater part of the state subject to infestation from the colonies in the eastern portion. Accordingly, after due notice, a hearing was held in Hartford on March 3, 1920, after which the following quarantine regulations were established:

State of Connecticut
Office of State Entomologist
Agricultural Experiment Station
New Haven, Conn.

Quarantine Order No. 2.

Concerning Gipsy and Brown-Tail Moths.

In order to protect uninfested parts of Connecticut from danger of infestation by the gipsy moth and the brown-tail moth, under authority given in Section 2106 of the General Statutes, the following regulations are hereby established.

1. The towns of Union, Woodstock, Thompson, Eastford, Pomfret, Putnam, Chaplin, Hampton, Brooklyn, Killingly, Scotland, Canterbury, Plainfield, Sterling, Lisbon, Griswold, Voluntown, Ledyard and North Stonington because of the gipsy moth, and all the above-named towns and Groton and Stonington because of the brown-tail moth are now under

quarantine by the Federal Horticultural Board of the United States Department of Agriculture, and it shall be unlawful to remove from this quarantined area any woody nursery stock, lumber, cordwood, telegraph or telephone poles, railroad ties, or other forest plant products, unless the products shall have been inspected and certified by an authorized state or Federal inspector.

2. In view of possible future changes in the lines between the infested and non-infested areas of the State, the areas quarantined by the State shall conform to those quarantined by the United States Department of Agriculture; furthermore the regulations established by the Federal Horticultural Board of the United States Department of Agriculture for interstate shipments, are hereby adopted for the inspection and certification of similar shipments from the quarantined area to points outside of this area within the State of Connecticut.

3. This order shall take effect from its date.

Dated March 23, 1920.

E. H. JENKINS,
Director, Connecticut Agricultural Experiment Station.

Approved
M. H. HOLCOMB,
Governor.

Instructions to Nurserymen, Lumbermen, Wood Dealers, Shippers and Transportation Companies.

Any shipments of nursery stock, or forest products originating within the quarantined area must not be shipped out of that area into the territory not infested, unless inspected and accompanied by the inspector's certificate. All shipments going into other States must be examined by a Federal Inspector, and the Federal Inspectors have also been authorized to inspect shipments consigned to points within the State: the State inspector can also examine such shipments in case of convenience or if the Federal Inspectors are busy elsewhere.

Transportation companies must not accept nursery stock or forest products consigned to points outside of the infested area unless accompanied by certificate of inspection.

INSPECTORS.

Federal Inspectors.

Herbert J. Miles, P. O. Box 62, Putnam, Conn. Telephone 321-14, Putnam. Inspector for Windham and Tolland Counties.

William J. Ahearn, Box 63, Westerly, R. I. Telephone 2277, Westerly. Inspector for New London County.

State Inspector.

John T. Ashworth, 26 Reynolds St., Danielson, Conn. Telephone 28-3, Danielson. Inspector for any shipments not going outside of the State.

So far the inspections have all been made by the Federal inspectors, and reports of all shipments to uninfested parts of Connecticut are sent to the office of the State Entomologist, where they are placed on file. The Federal quarantine also covers field stone and quarry products, but apparantly our state law (Section 2106) provides only for the control of shipments of plants or plant products.

Infestations Discovered in New Jersey and New York.

In midsummer an infestation of about one hundred square miles in extent was discovered on the Duke estate at Somerville, N. J. From a nursery on this estate many shipments had been sent during the past few years and in following up the destinations of these shipments several smaller infestations were found in New Jersey and one in Brooklyn, N. Y. Through the kindness of Mr. A. F. Burgess of the Bureau of Entomology, reports were received of eleven shipments of nursery stock from the Duke estate consigned to six parties in Connecticut. Most of these shipments were made between 1913 and 1916 and were sent to Greenwich, Stamford, Fairfield, Bridgeport, Ridgefield and Sharon.

Messrs. B. H. Walden and M. P. Zappe, Assistant Entomologists of the Station visited all of these places and inspected the plantations in and around the places where these plants were set. No indications were found of the presence of the gipsy moth in any of these places.

Recommendations.

On account of the existing conditions, we have reason to believe that the gipsy moth is now well in hand in Connecticut. If the work should be stopped, the pest would soon become sufficiently abundant to cause noticeable damage to trees by stripping them in June. State action would then be demanded. Such a possibility should not for a moment be considered, because the experience of Massachusetts shows its folly. Though confined to a rather small area in Massachusetts when the work stopped in 1900, the pest became so troublesome that the work was again taken up in 1905, but it was found to have spread over an area more than six times its former size and the difficulty and cost of control correspondingly increased. In Connecticut, the gipsy moth should be held just where it now is or the infested area reduced if possible.

Federal co-operation has been most cordial and satisfactory, but the Federal appropriation was reduced, and on account of the rather rapid spread northward, extra work was needed in Maine, New Hampshire and Vermont. Then, too, during the past summer new infestations were discovered in the states of New Jersey and New York, thus requiring that a portion of the Federal appropriation be used in those States.

The Connecticut forces are now fairly well equipped with spraying machinery and supplies, and with motor vehicles. The initial outlay for new apparatus should, therefore, not be very heavy for the next two years. Federal quarantine No. 37 has resulted in keeping out much of the imported nursery stock which formerly had to be inspected out of this appropriation. There will still be considerable fruit stock and Manetti rose stock for propagating, that must be inspected, but the quantity will be relatively

small, and the cost of inspection considerably less than in former years. As will be seen from the financial statement on page five, the cost of this work for the past year was $825.83, and it will probably be about the same for each season.

The appropriation for gipsy moth work should be sufficiently large, together with the possible Federal aid, to cope with any emergency such as a serious wind-spread. All things considered, we therefore respectfully request that sixty thousand dollars ($60,000.00) be appropriated for the biennial period ending June 30, 1923, for the purpose of suppressing the gipsy moth, the brown-tail moth, and for inspecting imported nursery stock.

EXPERIMENTS IN DUSTING IN COMPARISON WITH SPRAYING TO CONTROL APPLE INSECTS.

On March 30, 1920, entomologists from New York, New Jersey, Pennsylvania, Connecticut, and the U. S. Department of Agriculture held a conference at the Grand Central Station in New York City to consider a common plan for the testing of dust mixtures. It was agreed that it seemed desirable to conduct experiments in each of the states represented, to ascertain whether the common pests of the apple orchard could be satisfactorily controlled by dusting operations, and especially to learn if the addition of nicotine sulphate to the dust would control apple aphids and red bug.

The secretary afterwards prepared copies of the general plan of experiment and sent them with the minutes of the conference, to each entomologist who had been in attendance. In general the plans called for a dust containing 90 per cent. sulphur, and 10 per cent. arsenate of lead, to which nicotine sulphate was to be added in three different proportions, *viz.*, one-half of one per cent., one per cent., and three per cent. It was also recommended that one plot should be sprayed and one left untreated for purposes of comparison; that not less than 100 trees be included in the experiment; that standard varieties and rather large trees be used if feasible; and that at least four treatments be given (delayed dormant; pre-pink, calyx, and young fruit). In other respects the operations were to be conducted in conformity with the demands of the orchard and practices of the region where the work was conducted.

After examining several orchards, one owned by Mr. William F. Platt of Milford seemed to meet most fully the requirements. This orchard contained 30 acres, most of the trees having been planted 26 years, was in sod and was situated just over the line in the town of Orange. Consequently arrangements were made with the owner, to allow us to experiment on his trees and to furnish team and help where needed. The Station was to furnish materials and the owner was to have the fruit crop. The owner had given the entire orchard a dormant treatment with "Scalecide," one part in fifteen parts of water.

The detailed plan of the experiment was developed through the co-operation of the Entomological and Botanical Departments of this Station and the Division of Deciduous Fruit Insect Investigations of the Federal Bureau of Entomology, which has for several years maintained at Wallingford, Conn., a field station for the study of orchard insects.

To the owner, Mr. William F. Platt, to the Bureau of Entomology, to The Niagara Sprayer Company, and to the Botanical Department of this Station, our thanks are due for help and co-operation to make this work possible.

Most of the actual work was done by Messrs. B. A. Porter and C. H. Alden, of the Wallingford field station of the Bureau of Entomology, E. M. Stoddard and G. E. Graham of the Botanical Department, and M. P. Zappe, B. H. Walden, P. Garman and W. E. Britton of the Entomological Department of this Station.

The dust was applied with a Niagara power duster, owned by the Federal Bureau of Entomology and used in the experiments last year at Wallingford. Dr. Quaintance and Mr. Porter kindly granted us permission to use this machine. It was hauled about the orchard with a pair of horses owned by Mr. Platt as is shown on Plates IV and V, a. The liquid spray was applied with the owner's regular sprayer (a Friend power outfit) which is shown on Plate V, b.

The dust mixtures were prepared by the Niagara Sprayer Co., Middleport, N. Y., and 300 lbs. each of Formulas 1, 2, and 3, were furnished gratis for the experiments. These amounts were not sufficient, and later 100 lbs. Formula 1, 100 lbs. Formula 2, and 200 lbs. Formula 3, were purchased from this firm.

MIXTURES USED.

Formula 1	Powdered sulphur, 90 per cent.
Dust	Powdered lead arsenate, 10 per cent.
	Nicotine sulphate, one-half per cent.
Formula 2	Powdered sulphur, 90 per cent.
Dust	Powdered lead arsenate, 10 per cent.
	Nicotine sulphate, 1 per cent.
Formula 3	Powdered sulphur, 90 per cent.
Dust	Powdered lead arsenate, 10 per cent.
	Nicotine sulphate, 3 per cent.
Formula 4	Liquid lime-sulphur, 1 part.
Liquid	Water, 9 parts.
Spray	Nicotine sulphate, ¾ pint per 100 gallons.

Formula 4 was modified by diluting the liquid lime-sulphur at the rate of 1 part to 33 parts of water for the 2nd, 3rd and 4th treatments which were applied to the foliage, and 3 lbs. of powdered lead arsenate, per 100 gallons, was added.

The plan of that portion of the orchard where the experiments were conducted, showing the location of the plots and trees, is reproduced in figure 5.

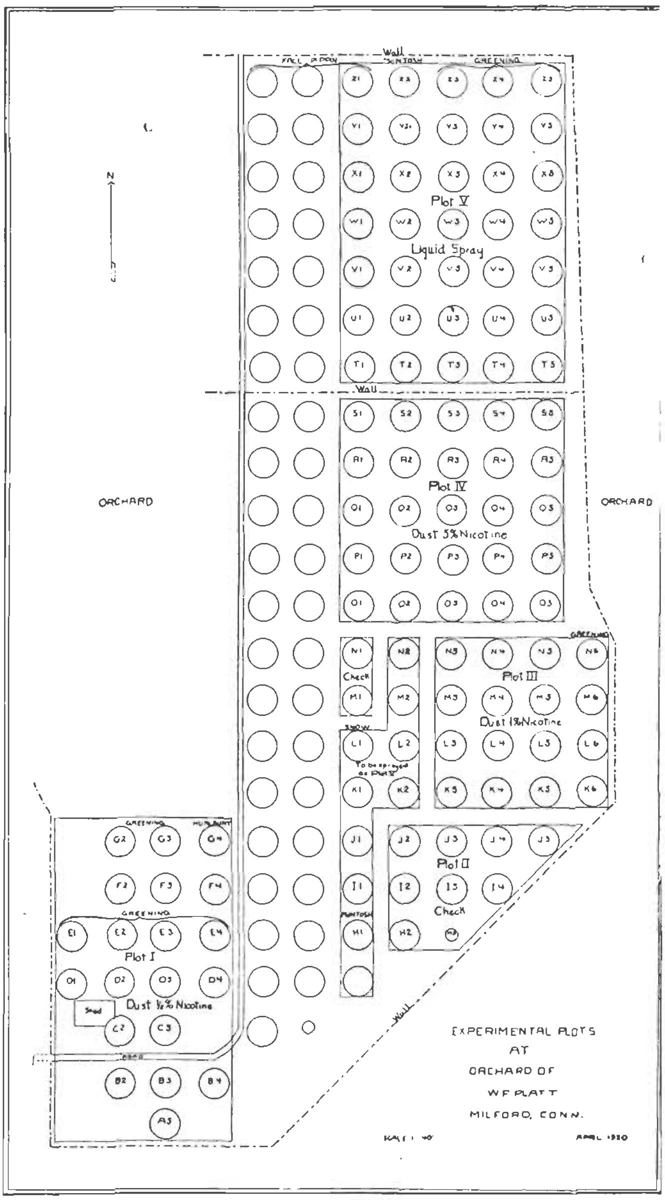

Figure 5. Plan showing arrangement of experiment plots, in or of W. F. Platt, Milford, where experiments in dusting and spraying conducted.

As to varieties, most of the trees were Greening; plot I had 18 Greening and 2 Hurlburt trees; plots II and III were all Greening; plot IV contained 15 Greening, 5 McIntosh and 5 Fall Pippin; plot V contained 21 Greening, 7 McIntosh and 7 Fall Pippin. In all, 104 trees were included in the experiment, and the remaining portion of the thirty acre orchard was sprayed by the owner with a weaker lime-sulphur (1 part to 66 parts of water), but at about the same time and in the same manner as plot V, and was available for collecting data and making observations.

This paper concerns only the treatments and their effects on the insect pests of the orchard. The effect on apple scab and other fungous diseases will be treated separately elsewhere by the Botanical Department.

The treatments given the trees on the different plots were as follows:—

TREATMENTS APPLIED.

Plot I.	Dust, Formula 1..............	20 trees.
Plot II.	Check. No treatment	8 "
Plot III.	Dust, Formula 2	16 "
Plot IV.	Dust, Formula 3	25 "
Plot V.	Liquid Spray, Formula 4.......	35 "
		104 trees.

Additional trees in rows adjoining plots II and III on the west were sprayed like plot V, with two trees saved as checks, to obtain data regarding effect on apple scab, by the Botanical Department.

The applications were made on the following dates:

1st Application	Delayed Dormant	April 22.
2nd "	Pre-pink	May 11
3rd "	Calyx	June 2
4th "	Young fruit	June 25

FIRST, OR DELAYED DORMANT TREATMENT.

Arrangements were completed to make the first application on the morning of April 22. It had rained all of the day preceding, and the trees were moist but not dripping. It was cloudy on the 22nd, with a gentle breeze from the northwest. The treatment began about 8 o'clock A. M., and was finished about 12.30. Messrs. Zappe, Stoddard and Porter made the application. The leaf buds showed a little green at the tips and green apple aphids had hatched and were present on the buds. The trees appeared to be well covered with dust. Living green apple aphids were observed partly covered with dust, about three hours after applying. Rain fell the following day.

For this treatment about 53 lbs. of formula 1; 60 lbs. of formula 2; 75 lbs. of formula 3; and about 150 gallons of formula 4 were used.

This first treatment was followed by cold weather and cold rains which retarded the normal progress of growth for this season of the year.

Second, or Pre-pink Treatment.

The second treatment was made on May 11. At this time the very foremost blossom buds began to show pink, but the others did not. The leaves were only partly developed, but enough so to catch and hold the dust and spray. The weather was ideal for making the application; it had rained a little the day before and it was still and partly cloudy. The work commenced about 8 A. M., and by 9.30 the dusting was finished. The spraying was finished about 11.20. About 4 P. M., a light rain set in which continued during a part of the night.

We ran out of materials of formula 3, before finishing plot IV, and used a little of formula 2, in order to finish. For the spray mixture liquid lime-sulphur was diluted at the rate of 3 gallons, with 3 lbs. of powerded lead arsenate for each 100 gallons. About 225 gallons of the liquid spray mixture were used in this treatment.

The applications were made by Messrs. Zappe, Porter and Stoddard. Very few aphids were present even on the untreated trees. No red bugs had yet appeared and the apple leafhopper, *Empoa rosae* Linn. was just beginning to hatch.

On May 12, a visit to the orchard revealed the fact that the dust was not appreciably washed off by the rains, and though it had collected in low places, or along the mid-rib, or at the tip, was still abundant on the leaves. No injury could be detected on any of the sprayed or dusted trees.

On May 17, another visit was made to the orchard. Bud worms were at work and there were only a few aphids present. Lady beetles were present in moderate numbers.

On May 25, visited orchard again. Greening trees were in full bloom and a few petals beginning to fall. There seemed to be more green apple aphids present than at any preceding visit and a few winged ones were seen. Only one nymph of the false red bug *Lygidea mendax* Reut. was seen, though in the orchard of F. N. Platt, perhaps a mile distant, they were rather common, and most of them were in the second instar.

Third, or Calyx Treatment.

This was made on June 2. The petals had all fallen except here and there a late flower remained. Began dusting about 7:30 A. M. It was quite still with a slight southwest breeze. Material was applied by Messrs. Zappe, Porter and Stoddard.

On June 4, visited the orchard. A light shower came on the afternoon of June 3, but it did not seem to wash off the dust. Found five red bugs in 3rd instar, one of which had left the terminal leaves and was on a cluster of four young apples, each of which had

been punctured several times. One colony of rosy aphid was noticed on one of the sprayed trees; green aphid had nearly all disappeared.

Visited orchard on June 8. Could not find any red bugs. A few leaf-eating larvae were found, dead. Also visited the orchard of F. N. Platt, and found plenty of red bugs on one tree in northwest corner of the orchard next to a piece of woodland. There was a bug on nearly every terminal shoot, and some of the bugs were already on the fruit clusters and beginning to puncture the young apples which were then about the size of small marbles. These bugs were in the 4th instar.

Fourth, or Young Fruit Treatment.

This was the final application and was made on June 25. There was a light breeze from the northwest. Apparently it required about four pounds of dust per tree, and about 300 gallons of the spray mixture was used. For this application the dusting machine was towed about the orchard with a Ford truck. Messrs. Zappe, Porter and Stoddard did the work. The McIntosh apples were about an inch in diameter at this time. A little of the rosy apple aphid was noticed, but red bugs were scarce. Leafhoppers (*Empoa rosae* Linn.) were present. In afternoon, visited F. N. Platt's orchard and found red bugs just transforming to the adult stage.

Messrs. Britton and Zappe visited orchard on July 2. There were many nymphs and adults of apple leafhopper present causing whitish spots on the leaves. Also visited F. N. Platt's orchard. Most of the red bugs had gone and only a few adults were seen.

General Seasonal Appearance of Trees.

There was little if any difference in appearance between the sprayed and dusted trees during the early part of the season. Both treatments controlled the leaf feeders in a fairly satisfactory manner. Now and then we found the bud worm at work on the tender terminal leaves. The check or untreated trees were not in such good condition though they were not eaten badly.

A slight difference became noticeable late in the season, for at harvest time the dusted trees seemed to have matured or ripened up earlier and had shed more leaves than the sprayed trees. Thus the sprayed trees were slightly greener. This applied to the foliage rather than to the fruit. No injury from any of the applications was noticed during the season. Nearly all of the trees produced fruit.

Scoring and Counting the Fruit

In order to obtain definite and accurate results on the effect of the treatment it was necessary to count and examine the fruit for

insect injuries from a certain number of trees in each plot. We attempted to select count trees from the center of each plot. Such trees would be less likely to be affected by the treatments given adjoining plots, because the dust and spray will sometimes be blown upon nearby trees. The following number of count trees were selected in each plot: plot I, 4 trees; plot II, 8 trees; plot III, 4 trees; plot IV, 8 trees, and plot V, 8 trees.

As most of the fruit falls which is badly injured by insects it was thought desirable to gather and score the dropped fruit as well as that remaining at harvest time. The drops from the count trees were therefore gathered about once each fortnight, counted, examined for insect and fungus injuries and a record kept. As the Fall Pippin and McIntosh apples matured earlier than the Greening, they were gathered and examined before the Greenings were harvested. On September 30, a few days before harvest time a severe storm took off a large proportion of the apples and these were also picked up, counted and scored separately.

It is interesting to note that the percentage of apples which were brought to the ground from the count trees by this storm varied considerably in the different plots as the following table shows:

FRUIT REMOVED BY STORM SEPTEMBER 30.

Plot.	No. Count Trees.	Percentage fruit dropped.	Treatment.
I	4	8.3	Dusted ½% nicotine.
II	8	25	Check No treatment
III	4	30	Dusted 1% nicotine
IV	8	23	Dusted 3% nicotine
V	8	17	Sprayed

On account of plot I being in the corner of the orchard, it was unquestionably somewhat protected by the nearby woodland trees and by the packing shed which stands amongst the trees of this plot. It is also on slightly lower ground than any of the others with the possible exception of plot II. With the exception of plot I, the sprayed trees (plot V) lost a slightly smaller proportion of fruit from the storm than the other plots.

The picking was done mostly by Mr. Platt's men, and the counting and scoring was done by Messrs. Porter, Alden, Stoddard, Graham, Zappe, Walden, Garman and Britton.

The dropped fruit was gathered four times for scoring and counting, on July 7, July 23, August 9, and August 30. The Fall Pippins were harvested September 10-15, and the McIntosh and Greening apples were harvested soon after October 1, the work being finished on October 13. This work involved the counting, separate handling, examination, and making record of each, of 159.668 individual apples.

Results of Treatments.

The results of the experiments might be given in detail as concerns each of the principal insect pests occurring in the orchard and attacking the fruit, but they are summarized in the accompanying table. It should be notéd that the sum of the percentages for each treatment does not equal 100, because the records of percentages for fungous diseases are not included in this table, and even if they were included, in most cases the percentages would total more than 100 because some fruits showed marks indicating that more than one pest had attacked them.

Statistics of Results.

Treatment.	Total No. of Apples.	Good per cent.	Red Bug per cent.	Aphis per cent.	Codling Moth per cent.	Curculio per cent.	Other Insects per cent.
Check.......	34,273	38.6	7.5	.85	4.77	21.00	5.3
Dusted:							
½% Nicotine.	20,290	60.8	7.1	2.31	.306	19.8	7.4
1% Nicotine.	23,972	86.5	2.05	2.82	.505	6.7	6.8
3% Nicotine.	44,486	82.6	1.66	.795	.398	5.25	4.5
Sprayed	36,647	88.0	1.66	1.665	.326	7.45	4.54

Discussion of Results.

It should be borne in mind that these tests represent only one season's work in one locality, and that quite different results might be obtained if the experiments were continued over a period of several years, or if duplicated in a number of orchards in different sections of the state. However, they are given here for what they are worth, and with certain reservations which are noted, may serve as a guide for future work. The percentage of good fruit was somewhat greater on the sprayed trees (plot V) than on any of the dusted trees though those containing one per cent., and three per cent. of nicotine (plots III and IV) were not very far below. The check or untreated trees gave only 38.6 per cent. of good fruit. The results as applied to the chief insect pests of the orchard are as follows:

Red Bug.—This insect was rather scarce in this orchard in 1920, but its injury was detected here and there throughout the orchard and the bugs were seen on a number of occasions. In all cases it was the false red bug *Lygidea mendax* Reut. The figures show that there was little difference between the sprayed trees (plot V) and those treated with one per cent. or more of nicotine in the dust (plots III and IV) but both those having less than one per cent. nicotine in the dust (plot I) and the check or untreated trees (plot II) gave more than three times as much red bug injury on the fruit as each of the other three plots.

Aphids.—Both the green apple aphid, *Aphis pomi* DeGeer, and the rosy aphid, *Anuraphis malifoliae* Fitch (*Aphis sorbi* Kalt.) were present in the orchard but not in sufficient numbers to make them very destructive. No doubt they were somewhat held in

check by the cold and rainy weather during the first half of the summer, and also by the lady beetles which were present. The percentage figures in the table as applied to aphids, appear to have no value, as the untreated trees (plot II) had less aphid injury than any of the other plots except that having three per cent.of nicotine in the dust (plot IV).

Codling Moth.—The codling moth *Carpocapsa pomonella* Linn. was held in check satisfactorily by both liquid spray and dust. Even the untreated trees (plot II) showed less than five per cent. of injured apples.

Curculio.—There was a large amount of injury (21 per cent.) attributed to the plum curculio, *Conotrachelus nenuphar* Herbst., on the untreated trees (plot II), and on the dusted trees containing only one-half of one per cent. of nicotine (plot I) it was only slightly less or 19.8 per cent. As it is a question if nicotine is of any value in controlling this pest and as the trees in plot I were treated with lead arsenate like those in plots III and IV, where the injury was less than one-third as great, some factor other than the treatment must be considered if an explanation is found. The trees of plot I surrounded the packing shed, and were separated only by a stone wall from a pasture partly covered with a growth of brush and some wood had recently been cut there. Possibly these conditions may have furnished better hibernating quarters for the beetles than obtained in the close vicinity of the other plots. The untreated trees (plot II) were only slightly nearer plot I, than was plot III, but it was on the southeast corner of the orchard. A stone wall extended along one side, not only of this plot, but also plots III, IV, and V, in which there was little difference in the amount of curculio injury.

Other Insects.—This category contains minor injuries by chewing insects which could not with reasonable certainty be attributed to codling moth or curculio, though it is possible that both these pests contributed. By far the major portion was due to gnawing of the fruit rather late in the season by Lepidopterous larvae, of which the bud moth *Tmetocera ocellana* Schiff., the lesser apple worm *Enarmonia prunivora* Walsh, and the red banded leaf-roller *Eulia velutinana* Walker, were recognized. The first was reared. There is practically no difference between the plots in regard to this kind of injury, but we believe that it might have been reduced considerably by one or two late applications. (See Plate VI, a).

Recommendations.

It would be unfair to draw final conclusions from these tests of a single season in one locality, and it is hoped that more work may be carried on the coming summer. We cannot advise orchardists to discard their spray outfits to take up dusting, though it is apparently possible to hold the chewing insects in fairly satisfactory control by the use of the dust treatment.

With the addition of nicotine solution some of the sucking insects, particularly false red bug, seem to have been checked, but the data are too meager upon which to base conclusions. The nicotine makes the dusting mixture very much more expensive.

The chief advantage of dusting over spraying is in the saving of time and labor. The disadvantage is in the cost of the materials and apparently this more than offsets the saving in time and labor, as the approximate cost of one treatment per tree was fully three times as great for dusting as for spraying.

If varieties are grown which are not susceptible to scab, and if sucking insects are not troublesome, dusting may give good results, but if these pests are serious in the orchard, better control will probably be obtained by spraying,—a method which has been in common practice long enough so that we know its possibilities. So many experiments have been conducted, that there is an abundance of data to show the value of spraying.

Probably new and more efficient, and possibly cheaper dust mixtures will be devised, but until that time the Connecticut orchardist may as well continue to spray.

Our experience in 1920, not only in Mr. Platt's orchard, but from observations in other orchards, leads us to advise strongly one or two additional and later treatments, in order to forestall the injury from codling moth larvae and other chewing insects late in the season.

NOTES ON THE LIFE HISTORY OF THE FALSE APPLE RED BUG IN CONNECTICUT.

Lygidea mendax Reuter.

BY M. P. ZAPPE.

During recent years this insect has become quite a serious pest in some of the Connecticut apple orchards. It is rather local in its appearance and consequently the injury which it causes is also local. During the summer of 1920, it caused considerable damage to both foliage and fruit in certain orchards. See Plate VII.

The eggs of this species are laid in the lenticels of the apple twigs and hatch at the time when the earliest blossom buds begin to show pink at the tips; most of the buds do not show any color at this time.

When first hatched the young nymphs crawl to the tip of the twig and begin to puncture the young tender leaves which at this time are about one inch long and there are an average of four uncurled ones on each cluster. In a short time the punctured leaves show reddish spots and the sides curl upward. See Plate VII, a.

When the nymphs are in the third instar a few of them begin to leave the terminal twigs and go to the fruit to feed, but the

majority of the young bugs do not leave the terminal shoots until they reach the fourth instar. At this time the apples are about the size of marbles. The nymphs when disturbed have the curious habit of dodging around to the back or opposite side of the leaf or twig. After they become winged they drop readily, spreading their wings as they drop. As a rule they do not fly far, usually alighting on a nearby branch. They do not live long as adults. Out of doors they were transforming to the adult stage on June 25, and on the 2nd of July very few adults could be found. Mating and oviposition were not observed.

Moults.

This insect passes through five moults before it reaches the adult stage. The length of time varies with the weather. The spring of 1920 was rather cold and backward and it took an average of 37 days from the time the eggs hatched until the adult stage was reached. The first newly hatched nymphs were seen on May 22 and the first adults on June 28.

First Instar. One day after hatching.

Color, carmine*, eyes darker red, with white margins. Antennae darker than body except last segment which is lighter. Legs colorless, rather transparent, and covered with small black spines. Beak colorless except tip, which is black. Black spot on middle of dorsal part of abdomen between third and fourth segments. Head with median groove. Dark oval pattern on dorsal part of thorax with median line running through the center. Abdomen one-third wider than thorax. Length 1.8 mm; width across thorax .33 mm; width across widest part of abdomen .66 mm.

Second Instar.

Abdomen not so wide in comparison to length but still a little wider than thorax and a little darker. Eyes much darker than rest of insect with paler margins. Legs darker than first instar. Black oval pattern of thorax seen in first instar is gone. Thoracic segments darker at edges Length 2 mm; width across thorax .5 mm.

Third Instar. Resembles second instar.

Body covered with fine white pubescence which becomes darker a few hours after moulting. Tylus black, antennae and legs darker than rest of body. Length 2.5 mm; width .87 mm.

Fourth Instar.

Wing pads appear in this stage and extend to cover the sides of the first abdominal segment. A deep fovea on each side of middle of second thoracic segment. Length 3.5 mm; width 1.33 mm.

Fifth Instar.

Wings in this stage extend to the sixth abdominal segment. Posterior third of wings and tip of abdomen dusky, also a dark line on the sides of the scutellum. Length 4 mm; width 2 mm.

Sixth Instar.

Adult stage. Bright orange red, antennae and narrow bar across the base of pronotum, black. Clavus, inner angles of corium, and membrane, fuscous; in dark specimens the scutellum and all but the narrow margin of the hemelytra fuscous; legs greenish yellow with fuscous on the tibiae. Length 6 mm; width 2.33 mm. The adult is shown on Plate VII, a.

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*Windsor and Newton's water colors in Smith's Explanation of Terms Used in Entomology.

CONTROL.

This insect may be controlled by spraying the trees just before the blossom buds open. Nicotine solution, 1 pint to 100 gallons of water, will hold the insect in check, especially if the tree can be sprayed from both sides at once. If only one side is sprayed at a time the young bugs have a chance to go to the opposite side of a leaf or twig and dodge the spray. This spraying may be combined with what is commonly known as the "pink spray,," which consists of arsenate of lead and commercial lime and sulphur.

As all of the red bugs probably will not be killed at this time, nicotine should be added to later sprays, especially the first calyx spray, soon after the petals fall.

LITERATURE.

Britton, W. E. False Apple Red Bug in Connecticut. Report Connecticut Agricultural Experiment Station, 1914 page 197, plate XXa: *Ibid.* 1915, page 185: *Ibid.* 1916, page 138.

Britton, W. E. and Zappe, M. P. Experiments in Spraying Apple Orchards to Control Aphids and False Red Bug, Report Connecticut Agricultural Experiment Station, 1917, page 259, plates II and III.

Crosby, C. R. The Apple Red Bugs, Cornell Agricultural Experiment Station, Bulletin 291, 1911.

Knight, Harry H. An Investigation of the Scarring of Fruit Caused by Apple Red Bugs, Cornell Agricultural Experiment Station, Bulletin 396, 1918.

Zappe, M. P. Apple Red Bugs, Twenty-Eighth Annual Report Connecticut Pomological Society, page 147, 1919.

NOTES ON THE LIFE HISTORY OF A SAWFLY FEEDING ON AUSTRIAN PINE.

Itycorsia zappei Rohwer.

BY M. P. ZAPPE.

On June 23, 1915, while collecting insects in New Haven, near some Austrian pines, a large sawfly was taken that looked different from anything in the Station collection. A special effort was made to collect a few more specimens which were flying around Austrian pines.

Several of these specimens were sent for determination to Mr. S. A. Rohwer of the Bureau of Entomology, who is a specialist in this family. He pronounced them an undescribed species of the genus *Itycorsia,* which he afterward named *zappei.* In the Proceedings of the U. S. National Museum, No. 2312, Vol. 57, page

209, Mr. Rohwer published the descriptions of both sexes of the adults.

The next summer larvae were found feeding in small silken webs on the new growth of the Austrian pines. The writer suspected that these larvae might have some connection with the adults that had been present on the trees, so a number were collected and reared. The following summer adults emerged and proved to be the same as those captured from the trees.

The Egg.

The eggs are laid singly on the needles of the new growth late in June and early in July. They are about 4 mm. long and are of a pale clay yellow color. They are crescent-shaped and are laid lengthwise on the needle, being fastened at the back. Both ends are up-turned and pointed, one tapering a little more than the other. When the young larva hatches it emerges from the end which tapers the least. See Plate VIII, a.

The Larva.

First Instar.

Length about 3 mm., body greenish yellow, first thoracic segment with a black marking extending from middle of one side to middle of opposite side with a black spot at each end. A black crescent-shaped mark at base of each leg. Two elongated black spots between each pair of legs on ventral surface of thorax. Legs black. Cerci at end of body with three segments, two distal segments black. Head rufous with appendages lighter. Antennae black with white rings at joints, last segment pointed at tip. Eyes black. Body covered with minute hairs. The eleventh segment bears a pair of atrophied prolegs.

Second Instar.

Length 6 mm. Head light brown with appendages black. Body greenish yellow, legs black. A narrow black stripe extends from base of first pair of legs to under side of head. Other markings same as in first instar.

Third Instar.

No change in markings or other characters from preceding moult.

Fourth Instar.

Head orange brown. Crescent-shaped marks at base of legs not so distinct except on first segment which still shows plainly though not so distinct as in preceding instar. Body becoming more or less glabrous except anal segment which has a number of rather long hairs.

Fifth Instar.

Markings above base of legs gone. Color of body darker green than in preceding instars except head and the first three segments and last two segments which are brownish. First segment has a dark brown bar on the dorsal surface.

Sixth Instar. (See Plate VIII, b.)

Larva entirely green except head which is still brown. There is a dorsal stripe of green darker than rest of body. In this instar the larvae stop feeding and go into the ground where they hollow out a small cell and pass the winter. In the late spring they transform to pupae and emerge as adults about the latter part of June.

The feeding period of the larva is just about one month.

Habits of the Larva.

When the young larvae hatch from the eggs they begin to spin a loose web around themselves, fastening the outer threads to the needles. As the larvae reach full size these webs are often four to five inches long and the larvae move up and down inside them by wriggling the body. The larvae have no prolegs and when removed from their webs and placed on a smooth surface, are unable to crawl until they have spun a sort of a web over themselves.

Their method of feeding is rather interesting. They usually begin at the top of their web and with their strong jaws bite off a needle at its base, just above the bundle sheath, very much as a cut-worm cuts off a plant. Then they proceed to eat it, beginning at the cut off end until they have devoured the entire severed needle. Then they take the next one. They have never been observed to leave their web and go to another twig. The larva in its case is shown on Plate VIII, c, and an empty case at d, of the same Plate.

The Adult.

In order to bring together in one publication the descriptions of all stages of this insect, the original descriptions of the adults as published by Rohwer, in the Proceedings of the U. S. National Museum, Vol. 57, page 209, 1920, are given below.

Itycorsia zappei Rohwer.

"Of the North American species, this new species is probably most closely allied to *maculiventris* (Norton), but the male differs in a number of ways from the description given for that species, and the description of the female given by MacGillivray does not agree in all details with the female of the species described here. In MacGillivray's key to the species of *Itycorsia* of Connecticut (Bull. 22, Conn. Geol. and Nat. Hist. Survey, p. 33) this species runs to couplet 6, but differs from both *luteomaculata* (Cresson) and *albomaculata* (Cresson) in the black cypeus and other minor characters. Of the European species it seems to be more closely allied to *stellata*, but differs from the descriptions of that species in the color of both adult and larva."

"Female.—Length 13 mm. Anterior margin of the clypeus truncate; medianly the clypeus is strongly raised by the extension of the antennal carina; its surface is shining, impuncate; median fovea deep, elongate; area above the frontal crest with rather close, small punctures; median ocellus in a diamond-shaped depression; posterior ocellus bordered laterad and caudad by a deep furrow; posterior orbits and vertex shining, with large widely separated punctures, frontal crest obsolete; antennae 31-jointed, the third joint slightly longer than the fourth and fifth combined; prescutum shining, practically impunctate; scutum shining, with a median area of close, large punctures; scutellum shining, practically impunctate; mesepisternum subopaque, with sparse, rather large, setigerous punctures. Black; spot on the mandibles at base, spot on the superior orbits, two spots on the vortex, spot on the occiput behind the eye, and with a line-like projection toward the supraorbital spot, the posterior margin of the pronotum, tegulae, two spots near the posterior margin of the prescutum, two spots along the notauli on the scutum, two large spots on the scutum posteriorly, a small spot on the lower posterior orbits, an elongate spot on the mesepisternum dorsally, circular spot on the sides of the pronotum

most of the metepisternum, dorsal and ventral margins of tergites, the apical margin of the sternites 3, 4, 5, and 6, yellowish-white; legs black; the tibiae and basal joints of the anterior tarsi rufous; wings hyaline basally, fuliginous beyond the basal margin of the stigma; venation dark brown."

"Paratype females show that this species may vary as follows: the spot on the metepisternum may be greatly reduced; the line projecting toward the supraorbital spot may be complete or entirely absent; the yellow spot on the lower margin of the posterior orbits is usually wanting."

"Male.—Length 8.5 mm. In puncturation and characters of the head, the male agrees with the above description of the female, except the declivous face is a little more sharply defined on the frontal crest, however, the frontal crest is rounded and not margined; antennae 31-jointed; the third joint slightly longer than the fourth and fifth; hypopygidium broadly rounded apically. Black and yellow; antennae yellowish-ferruginous, apical half brownish; scape above black; head black; mandibles except apices, clypeus except two points medianly, lateral supraclypeal area, area between the antennae and extending caudad in two lines to the level of the anterior ocellus, the lateral orbits near the top of the eye where they narrow and extend almost to the middle of the occiput, supraorbital spot, connected with the line extending posteriorly to meet the line of the occiput, two spots on the vertex, yellow; thorax black, the posterior dorsal margins of the pronotum, tegulae, most of the prescutum, two spots on the scutum anteriorly, spots on the scutum posteriorly, the scutellum, most of the metepisternum, sternum, metepimerun, and episternum, yellow; sternites, and tergites ventrally, and the lateral margin of the tergites dorsally yellow; the rest of the tergites black; legs yellow with the base of the coxae posteriorly, line of the femora and trochanters posteriorly black; wings hyaline; venation dark brown; costa and also margin of the stigma yellowish."

"Type Locality.—New Haven, Connecticut. Described from eight females and two males collected by M. P. Zappe for whom the species is named. The type female was collected as a larva August 2, 1916, on Austrian pine and emerged June 7, 1917. It is recorded under No. 670 Connecticut Agricultural Experiment Station. The type male and the paratype male were collected as larvae on August 2, 1916, on white pine, and emerged June 26, 1917, and are recorded under No. 669 Connecticut Agricultural Experiment Station. The other females were collected in June and July, 1915."

"Type, Allotype, and four female Paratypes.—Cat. No. 21605, U. S. N. M."

"Three female paratypes and the male paratype returned to the Connecticut Agricultural Experiment Station."

TESTS OF SOAP SPRAYS TO KILL THE PINK AND GREEN POTATO APHID.

Macrosiphum solanifolii Ashmead.

By M. P. Zappe.

During the summer of 1920 there was a local outbreak around New Haven of the pink and green potato aphid which has done considerable damage during the last three or four years. At Woodmont there was a rather heavy infestation in two large fields of about sixty acres of potatoes. The owner came to the Station for advice. He did not wish to spray unless it was absolutely neces-

sary. In one of the fields there were large numbers of parasites and parasitized aphids present, also many lady-beetles and their larvae. A fungous disease was also present and had killed quite a large number of the aphids, consequently it did not seem worth while to spray the potatoes in this field. In the other field, however, the infestation on the Green Mountain variety was rather heavy, and though parasites were also present, they were not nearly as abundant as in the first field.

It was decided to spray the second field and keep a close watch on the other. The usual spray of nicotine solution and soap was recommended, but on account of the scarcity of labor the owner wished to avoid the task of dissolving the soap. But if he did have to dissolve soap, he felt that he might better use a little more soap in the spray and omit the nicotine solution (which had advanced in price from $10.75 to $13.75 per ten pound package).

Soft soaps were suggested and a cheap kind of soft soap was procured at one and one-half cents a pound and tried on a small scale. A chemical analysis showed the soap to be 93 per cent. water with a very large excess of free alkali. There was so much free alkali that it would burn one's hands. This soap proved to be of little value for killing aphids even when used as strong as one part soap to two parts water.

Another soft soap which was intended for washing automobiles was tried with much better results. This soap was a better grade of soap than that just mentioned. It was made with a linseed oil base and contained only 56.2 per cent. of water. This soap cost twenty-five cents a pound wholesale in twenty-five pound pails. When used at the rate of one-half ounce to one gallon of water, this soap was 100 per cent. effective in killing the aphids on dipped potato plants. Part of the second field of potatoes was sprayed with this soap with very good results. The sprayer was of the four-row type with three nozzles to each row. The lower nozzles could be turned up at any angle desired so that the underside of the leaves could be easily sprayed. See Plate VI, b.

Still another brand of automobile soft soap was tried. This was claimed by the dealer to be just the same as the soap described above, but the price was much higher (thirty-eight cents a pound in five pound pails) and it was not nearly so effective in killing aphids. To get the same result, over twice as much soap had to be used.

THE EUROPEAN RED MITE, A NEW ORCHARD PEST IN CONNECTICUT.

Paratetranychus pilosus Can. and Fanz.

Order Acarina — Family Tetranychidae

BY PHILIP GARMAN.

A number of Connecticut orchardists observed with no little concern during the past season, the damage caused by the European red mite. Most of them had little success with the ordinary insect control measures which consisted for the most part of lime-sulphur, nicotine and lead arsenate preparations applied in accordance with the usual spray calendar recommendations. In consequence, it is important to state what is known of the habits and control of the mite under local conditions as well as to indicate what measures have been successful for similar troubles in other localities. Considering the fact that the pest is often mistaken for others less injurious, it is also important to describe its structure and indicate characters for its recognition. These facts together with a history of the pest in Connecticut will form the present statement regarding the European red mite.

DISCOVERY IN CONNECTICUT.

About July 2, 1920, Doctor Britton, State Entomologist, visited the orchard of Mr. Frank N. Platt, of Milford. He noted there a tree which had brown leaves, and thought from appearances, that the red spider (*Tetranychus bimaculatus* Harvey) was responsible. Examination of leaves brought by him to the laboratory showed them to be infested with the European red mite, a species not hitherto reported from Connecticut. Examination of material brought from Milford earlier in the season by Mr. Zappe led to the suspicion that there was something different in hand, but the pest was identified from material obtained later. Referring then to the Experiment Station collection of unidentified mites, a single slide was found which contained the same species. This was collected by Mr. Zappe at Clintonville, in the town of North Haven, April 17, 1917. Eggs were also received in the fall of 1919 on a small peach twig. These were allowed to hatch and a comparison of the larvae with those obtained later showed that they are the same.

DISTRIBUTION.

The above observations indicate that the European red mite has been in Connecticut at least three years. During the last year it has been found in Greenwich, Danbury, Milford, Branford, Wallingford, Middletown and Meriden. It is reported from Canada (Ontario), Pennsylvania, and is thought to occur in New

Jersey. Probably it has a much wider distribution and has in many cases been mistaken for the red spider (*Tetranychus bimaculatus* Harvey) or the clover mite (*Bryobia pratensis* Garman).

DESCRIPTION.

Adult mites are dark velvety red in color, the young somewhat brighter. The eggs are dull red.

The egg is slightly flattened above, is radially grooved and has a short stalk arising from the center, the stalk being slightly longer than the vertical diameter of the egg. It measures .15 mm. in diameter when fresh. See figure 6, 2, and for appearance of eggs on twig, Plate IX, b.

The larval and nymphal stages are similar to the adult female in general appearance; but are smaller in size and the larva has only three pairs of legs instead of four.

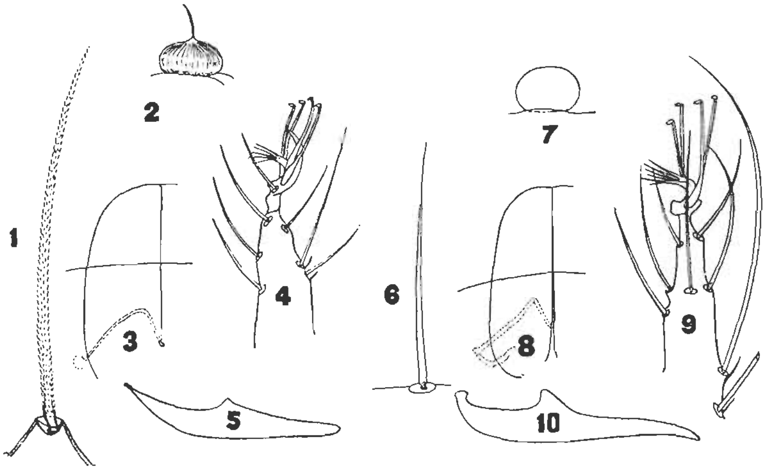

Figure 6. Structures of European red mite *Paratetranychus pilosus* Can. and Fanz. and common red spider *Tetranychus bimaculatus* Harvey.

1, *Paratetranychus pilosus*, seta of dorsum 846 times enlarged; 2, egg, 14 times enlarged; 3, collar trachea and mandibular plate, 714 times enlarged; 4, tarsus of first pair of legs of female, 921 times enlarged; 5, penis, 1400 times enlarged.

6, *Tetranychus bimaculatus*, seta of dorsum, 846 times enlarged; 7, egg, 14 times enlarged; 8, collar trachea and mandibular plate, 714 times enlarged; 9, tarsus of first pair of legs of female, 921 times enlarged; 10, penis, 1400 times enlarged.

The adult female is about .31 mm. in length. There are 26 setose dorsal bristles arising from small tubercles (see figure 6, 1) which when viewed with a lens of small magnifying power appear as white dots. The tarsi, or last segment of the legs, is provided with a single claw, widest at the mid point and with apparently five (there are probably six) appendiculate spurs projecting at right angles (see figure 6, 4). There are also four tenent hairs with hooked tips arising from the base of the claw and exceeding it considerably in length. The mandibular plate (see figure 6, 3) is similar to that of most other red spiders, but the collar

trachea consists of a simple tube suddenly dilated at the tip to form a nearly spherical chamber. The maxillae consist of about four segments, each of which is tipped with a short spatulate body probably representing an additional one. The next to the last segment has a strong hook, and the last has five setae (two apical, two basal on the dorsum, and one lateral) and a clavate hair between the two dorsal pairs.

The male is much smaller in size and the tip of the abdomen is more pointed than in the female. The male genitalia of the different species of red spiders are characteristic of each.

Probably the most closely related representative of the red spider family is the west coast mite, known as the citrus red spider (*Paratetranychus citri* McGregor[1]). This mite does similar damage to fruit trees in Oregon and differs from the European red mite only in minute characters of the male genitalia, and the mandibular plate. The egg, however, seems to have a longer central stalk and the guy fibrils reported on the citrus mite egg have not been seen in the egg of the European red mite.

There are abundant differences, however, between the European red mite and the ordinary red spider (*Tetranychus bimaculatus* Harvey). The dorsal hairs are smaller (see figure 6, 1 and 6), the collar tracheae are different (see figure 6, 3 and 8) and the tarsi lack the large claw (see figure 6, 9). The male genitalia are also different (see figure 6, 5 and 10.)

The only other mite which seems to be confused in the minds of some is the clover mite (*Bryobia pratensis* Garman) which, however, bears little resemblance. The clover mite has a much wrinkled skin, is usually purplish or brown in color, and bears around the margin of the body a number of small flat movable plates. There are also two claws on each tarsus instead of one and the front pair of legs is much longer than any of the others. The eggs are larger, measuring .20 mm. in diameter, and lack the radial grooves and central stalk.

Habits and Life History.

The European red mite passes the winter in the egg stage. Large numbers are laid in the fall on twigs from the size of a lead pencil to three-fourths of an inch in diameter. They are frequently found several layers deep about bud scars or in crevices in the bark. Apples are also selected for egg laying, the eggs being frequently placed in the calyx cavity as shown on Plate IX, b. Here they are protected from being rubbed off in handling and are doubtless carried from place to place in the shipment of fruit. Under favorable conditions they may hatch, and regain a host, thus starting a new colony.

Emergence takes place early in the spring though the exact time cannot be stated for this locality. In Sweden the eggs of the same mite hatch about the first of May and young mites were observed in 1920 about this time in Connecticut. From then on they develop rapidly if conditions are suitable, and several generations probably develop before the winter eggs are laid. In 1920, they became much reduced in numbers on the leaves about the

[1] = *mytilaspidis* Riley.

first of August, and very few could be found, although numerous cast skins were present on the leaves. The greatest development therefore took place between May and August (in 1920) and it is probable that most damage was done in June. The different stages consist of a larva, three nymphal, and the adult stage. Eggs, larvae, nymphs and adults may be found on the leaves at the same time so that there appears to be no definite brood limits.

The European red mite spins little or no web. Larvae spin more than adults, but they never produce as much web as the common red spider.

Observations in Various Orchards.

The first extensive leaf injury was seen in Plant Brothers' Orchard, Branford, Connecticut. Here a large block of Baldwin was affected, the leaves having turned brown and the injury being visible as far off as the orchard could be seen. A block of Greening in the same orchard appeared to be untouched, but examination of the leaves showed that there were a good many mites present. Doubtless there is some difference in the vitality of the two varieties, the Greening being better able to withstand injury. In this and other orchards injury from mites was seen on Baldwin, Ben Davis, McIntosh, and Hurlburt, but in nearly every case the Baldwin showed the effects of infestation more than other varieties.

Infested trees lose some of their foliage and the size of the fruit is affected. Examination of Baldwin fruit in the Plant Brothers' orchard, selected from injured and uninjured trees of approximately the same age and size, showed a marked reduction in the size of apples from the injured trees. One Baldwin tree observed in the orchard of Mr. Frank Platt, near Milford, had almost no marketable apples. (See Plate IX, a.)

An effort was made to determine what sprays were used in orchards showing the worst injury. The Plants' orchard proved to be the most instructive, and showed that attention must be given to early sprays, especially the delayed dormant application. This spray apparently should not be diluted more than 1 to 9 in the case of lime-sulphur, and should be applied with great care to cover as much of the tree as possible.

Recommendations of Other Investigators.

Sulphur in some form is usually recommended for control of red spiders. Sulphur dust is said to require an average temperature of 75° F., (7, page 523*,) in the shade, to be effective, but just how it kills is not well understood. It is thought that it vaporizes at this temperature and that the fumes do the work; and it apparently acts only at short range.

*See literature at the end of the article.

Lime-sulphur solution is more frequently recommended, the dilute strength (1-50) being necessary for summer use. It is said to kill by contact, but it is slow in doing its work, and acts over a considerable period of time. The self-boiled mixture is recommended by some (4, page 34), and the addition of flour-paste to dilute lime-sulphur by others (6). Kerosene emulsion (8, page 208) and Scalecide are also encountered in recommendations for red spider control.

In Oregon (2, page 87), one of the most effective controls appears to be afforded by a combination of nicotine sulphate and lime-sulphur or scalecide. It is thought that the eggs are not killed by winter strength lime-sulphur, but observations on the citrus mite indicate that the continued action finally kills a large per cent. of the mites, after hatching.

TABLE I

LABORATORY TESTS OF VARIOUS INSECTICIDES ON THE EUROPEAN RED MITE

Material Used.	Number killed.	Number alive.	Per Cent. killed.	Examination after.	Date.
Sulphur dust......	1	12	7.6	6 hrs.	July 28
" "	1	18	5.2	24 hrs.	July 28-29
" "	19	45	29.6	48 hrs.	July 28-30
Lime sulphur 34° Bé 1 gal.-43¼ gals...	7	6	53.8	6 hrs.	July 28
"	17	3	85.0	24 hrs.	July 28-29
"	79	28	73.8	48 hrs.	July 28-30
Borax Soap 2 lbs.,- and 40% Nicotine Sulphate ¾ pint 50 gals..........	15	3	83.3	6 hrs.	July 28
"	26	1	96.2	24 hrs.	July 28-29
"	114	5	95.7	48 hrs.	July 28-30
Borax Soap 6 lbs.- 50 gals..........	33	0	100.0	6 hrs.	July 28
"	20	2*	90.9	24 hrs.	July 28-29
"	141	6	95.9	48 hrs.	July 28-30
Borax Soap 4 lbs.- 50 gals..........	23	2	92.0	12 hrs.	July 28-29
Amalie Auto Soap 4 lbs.-50 gals.....	15	5	75.0	12 hrs.	July 28-29
6 lbs.-50 gals.....	12	5	64.1	12 hrs.	July 28-29
Check No. 1......	3	21	12.5	6 hrs.	July 28
"	5	21	19.2	24 hrs.	July 28-29
"	55	321	14.6	48 hrs.	July 28-30
Check No. 2......	1	29	3.3	12 hrs.	July 28-29

*[illegible]

Material used.	Number killed.	Number alive.	Per Cent. killed.	Examination after.	Date.
Fels Naphtha Soap					
4 lbs.-50 gals.....	18	0	100.0	6 hrs.	July 28
"	15	0	100.0	24 hrs.	July 28-29
Star Soap					
4 lbs.-50 gals.....	21	0	100.0	6 hrs.	July 29
"	23	2	92.0	24 hrs.	July 29-30

Table II

Results of Field Tests in the Plant Brothers' Orchard
Branford, Conn.

Treatment.	Killed.	Alive.	Per Cent. killed.	No. of trees used.
Soap 4 lbs.-50 gals..........	125	139	47	24
Soap 2 lbs. and 40% Nicotine Sulphate 1 pint-50 gals................	69	75	48	24
Check.....................	66	119	36	24
Dust 90% Sulphur 10% Arsenate of lead 3% Nicotine sulphate	No difference could be seen between check and treated blocks.			35

All treatments in Table II were made July 28, 1920.

Welcome borax soap was used, and Black Leaf 40. Dusting was done about noon. The counts were made by selecting twigs at random from trees in the center of the block and examining with a binocular. The examination was made August 5, and also several weeks later. No counts were made at the later date.

Literature.

1. Caesar, L. Can. Entomologist, 47; 57-58; 1915.
2. Ewing, H. E. The Common Red Spider or Spider Mite. Oregon Agr. Expt. Sta., Bul. 121; 1914.
3. Frost, S. W. Journ. Econ. Ent., 12; 407; 1919.
4. Lovett, A. L. and Fulton, B. B. Oregon Agr. Expt. Sta., Circ. 22, 1920.
5. McGregor, E. A. The Red Spiders of America and a Few European Species Likely to be Introduced. Proc. U. S. Nat. Mus., 56; 641-679; 1919.
6. Parker, W. B. Flour Paste as a Control for the Red Spider and as a Spreader for Contact Insecticides. U. S. Dept. Agr., Bur. Ent., Circ. 166; 1913.
7. Quayle, H. J. Red Spiders and Mites of Citrus Trees. California Agr. Expt. Sta., Bul. 234; 1912.
8. Slingerland and Crosby. Manual of Fruit Insects, page 208; 1914.
9. Trägårdh, Ivar. Bidrag till Kannedon om Spinnkvalstren (Tetranychus Duf.). Med. nir. 109, fr. Cent. f. förs, på jordbr. Entom. avdel. n: r 20, 1915.

THE APPLE AND THORN SKELETONIZER IN CONNECTICUT.

Hemerophila pariana Clerck.

This is an European species which has recently become established in this country. It first appeared in Westchester County, N. Y., and its presence in the United States was mentioned by Doctor E. P. Felt in a Scientific Note in the Journal of Economic Entomology, Vol. 10, page 502, August 1917. Later a full illustrated account giving habits, descriptions, partial life history and bibliography appeared in the Thirty-third Report of the New York State Entomologist for the year 1917, and it is from this publication that the chief facts were gleaned for use in the present paper.

Doctor Felt had warned us to be on the watch for the insect in Fairfield County, Connecticut, because he had observed it very near the Connecticut border in Westchester County, N. Y., but the first report of its occurrence within the state was made over

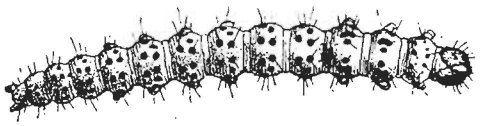

Figure 7. Larva of apple and thorn skeletonizer, six times enlarged. (After Felt, Cornell Extension Bulletin 27, 1918.)

the telephone in the autumn of 1920 by Mr. F. A. Bartlett of Stamford, who stated that the insect was quite abundant in the vicinity of Belle Haven, Greenwich. At my request he gathered some material and sent for examination. This reached the laboratory November 13. From Doctor Felt's published descriptions, we were able to identify it as *Hemerophila pariana* Clerck. On November 18, Messrs. Walden and Zappe of this department visited the locality and gathered more material from which an adult moth emerged on December 7. According to Mr. Bartlett, the insect occurs in the towns of both Greenwich and Stamford. Belle Haven is situated in the southwestern part of Greenwich adjacent to the town of Rye, N. Y.

Nature of Injury.

The caterpillars feed upon the upper surface of the leaves sometimes entirely skeletonizing them, but often leaving a portion untouched at each margin at the base of the blade. Each larva spins a light web over the center of the leaf, curling the leaf upward and drawing together the margins especially toward the tip. The

extent of injury varies from only slight feeding to entire skeletonization and is shown on Plate X, a.

The leaves are not webbed together like the nests of the fall web-worm. In the worst infested sections of Westchester County, N. Y., some of the unsprayed orchards are completely defoliated.

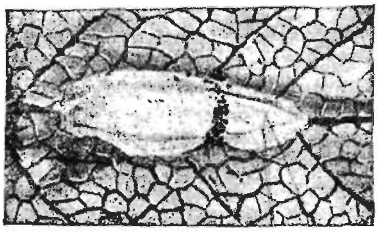

Figure 8. Cocoon of apple and thorn skeletonizer on leaf, twice natural size. (After Felt, Cornell Extension Bulletin 27, 1918.)

Distribution.

According to Doctor Felt, this insect has been recorded from England, France, Germany, the Balkan Peninsula, Bithynia and western Asia including Turkestan.

In America it is known to occur only in Westchester and Rockland Counties in the State of New York, and in Greenwich and Stamford, Fairfield County, in Connecticut It is not known how long the insect has been established in the United States or how it was introduced here, but the probabilities are against rapid dissemination, though its range in Europe and Asia indicates that the insect may be able to maintain itself over a greater portion of the United States and southern Canada.

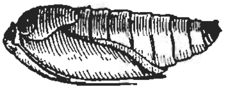

Figure 9. Pupa of apple and thorn skeletonizer, six times enlarged. (After Felt, Cornell Extension Bulletin 27, 1918.)

Life History.

The life history has not been completely worked out in this country, but the data collected by several entomologists in Europe indicate that there are at least two and probably three generations each year. It is thought that the insect passes the winter in both the adult and pupa stages, the former in any shelter, and the latter in the cocoon on the leaf. Doctor Felt reports much variation in the development of the insect at Irvington, N. Y., as very small and full-grown larvae were both found together in September and early October. Probably the larval or feeding stage lasts from

four to six weeks. As injured leaves seem to be rather uniformly distributed over the tree and throughout the orchard, it is suggested by Doctor Felt that the moths may deposit a few eggs near the base of each leaf. Particularly when abundant, the moths seem to oviposit on nearly every leaf.

In Europe the adults are found on the flowers of the Compositae, especially goldenrod.

Though the insect shows a preference for apple, the list of food plants in Europe includes also pear, hawthorn or thorn, mountain ash, birch and possibly willow. Several Hymenopterous parasites have been reported by European writers and one, *Dioctes obliteratus* Cresson, has been reared in New York State.

Description.

Larva:—Length nearly one-half inch when full-grown, greenish-yellow in color with black, tubercular spots varying greatly in size and bearing hairs. Head amber, with irregular dark-brown line at the lateral dorsal angle adjoining the first thoracic segment. Antennae yellowish brown, legs pale yellow.

Pupa:—Length, about one-fourth of an inch, rather stout, dark bronzy yellow, head dark-brown. The white silken cocoon is about five-eighths of an inch long and one-fourth of an inch broad, fastened to the upper surface of the leaf, frequently along the mid-rib. The pupa can be seen faintly, and before the moth emerges, wriggles partly out from the cocoon, the pupal shell often projecting from it. (See Plate X, b.)

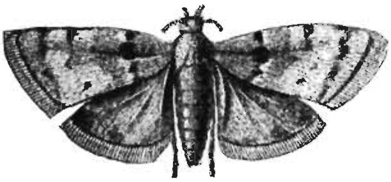

Figure 10. Adult of apple and thorn skeletonizer, four times enlarged. (After Felt, Cornell Extension Bulletin 27, 1918.)

Adult:—Wing-spread of slightly less than half an inch, grayish-brown to dark brown usually with purplish tinge, fore-wing marked with a rather broad broken angulate dark band near basal third, and another less distinct but more regular dark band crossing the wing near the distal fifth. Area between these bands is grayish but variable in color, and usually marked by one or more dark spots near the costal margin. The head, thorax and abdomen are covered with dark brown scales shading into or mottled with yellowish-brown or purplish-brown and quite variable. Rear wings dark fuscous. Both wings margined with purple fringe. Under side lighter with two whitish spots on costal margin of fore-wings.

Illustrations of the larva, cocoon, adult moth and the injured leaves are shown in figures 7-10 and on Plate X, a. and b.

Control Measures.

As the larvae feed upon the upper surface of the leaf, timely and thorough applications of lead arsenate will probably readily con-

trol this pest. It may be necessary to spray rather late in summer in order to check the late brood. It is reasonably certain that such measures will forestall injury in orchards, where the owners make a practice of spraying, but there are so many neglected trees throughout Connecticut that there is great danger that the insect will subsist upon them and gradually become distributed all over the state. If all trees in and around the infested region could be sprayed in this manner, it would be an effective check on the spread of this insect.

LITERATURE.

Felt, E. P. Journal of Economic Entomology Vol. 10, page 502, 1917.
Cornell Extension Bulletin, No. 27, 1918.
Report Ontario Entomological Society, 48, page 44, 1918.
Report New York State Entomologist, 33, page 33, 1918.

THE SINUATE PEAR BORER.

Agrilus sinuatus Olivier.

This European beetle causes serious injury to pear trees in France and Germany, and was first discovered in this country in New Jersey in 1894. Apparently it was introduced in nursery stock. It seems to have spread rather slowly and in 1915 Doctor Felt* reported that the insect was known to occur in several localities in New York State. The first indication of its occurrence in Connecticut was on May 29, 1917, when we received from Mr. G. S. Brown, Norwalk, a piece of bark from a pear tree which seemed to show the work of this insect, and a note to that effect was printed in the Station Report (1917, page 361). On a visit to Stamford on June 24, 1920, the writer examined a small pear orchard on Strawberry Hill, where many of the trees were attacked, injured, and some of them seriously deformed by this insect. According to Mr. F. A. Bartlett of Stamford, considerable injury has been noticed by him in the pear orchards in Stamford and Greenwich.

Mr. H. B. Weiss† in 1914, reported the insect as being present in Essex, Union, Middlesex and Bergen Counties in New Jersey, and states: "While it is true that it is not abundant every year, it is customary to run across its work in the northern part of the state. In spite of the fact that it is no longer destructive, it is evidently holding its own in a small way and spreading somewhat."

All varieties of pear are infested. The Bartlett seems to be preferred, and the Keiffer, though attacked, is not seriously injured.

CHARACTER OF INJURY.

The larva, which is one of the flat-headed borers, makes a long narrow and winding burrow under the bark chiefly in the sapwood.

*Report of the Entomologist of New York, 31, page 78, 1915.
†Journal of Economic Entomology, Vol. 7, page 251, 1914.

These burrows are rather conspicuous, especially in young trees having a smooth bark. The nearly-grown larvae make burrows which are much larger than those made by the first-season larvae and consequently they are more conspicuous. Trees of all ages are attacked and injured. Small trees are sometimes girdled and killed by intersecting burrows, and large trees are weakened and sickly often losing branch after branch, and finally die. Many instances were noticed where the galleries had killed the bark on one side of a branch while the other side appeared healthy.

Life History and Habits.

The adult beetles appear late in May and during June, and deposit their eggs in the crevices of the bark. These eggs hatch in early July and the grubs begin their sinuous tunnels which are very narrow at first but gradually increase in diameter as the grubs grow. On the approach of winter, the grub stops feeding and rests in its burrow until spring, then continues its work. The second summer the grubs are much larger and of course the burrow corresponds in size. The zigzag or sinuous course which is downward is very pronounced. The bark over the burrows is somewhat depressed, blackened and often cracked, so that an infested tree can usually be recognized at a glance. Smith* states that in no case has he ever seen a complete girdling by a single larva, but where two or more larvae happen to work in the same branch, their galleries often meet and if a small branch or a small tree, it may result in a complete girdling and that part above the injury dies. This is more apt to happen the second season than the first. In September of the second season the larva eats its way into the wood about one-fourth of an inch and makes a cell or enlarged burrow lengthwise the stem. At the opposite end of this cell the grub eats its way to the bark and plugs both ends of its cell with sawdust. In this chamber it passes the winter, gradually contracting in length, and pupating in the cell the following April. The location of this pupal cell is visible in young trees or in the smaller branches of large trees, as the bark is somewhat sunken and blackened, the blackening extending into the wood and probably being due to a fungus. The beetle then emerges through a semicircular hole in the bark.

According to Doctor Felt† the studies of Doctor H. Glasgow of the New York Agricultural Experiment Station at Geneva, N. Y. show that the beetles feed readily upon the foliage. This habit may make it possible to control the pest by the use of arsenical sprays applied late in May or just before the beetles emerge. The adults are found flying about on sunny days or resting upon the bark of the trunk or branches.

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*New Jersey Agricultural Experiment Station Report for 1894, page 558.
†Report New York State Entomologist, 31, page 79, 1915.

DESCRIPTION.

Larva:—Length, about one and one-half inches when full-grown; very flat, white or yellowish, head small and brown, with prominent mandibles. The first thoracic segment is much enlarged about twice as broad as the abdominal segments and having somewhat the appearance of a large head, but flattened like the other segments; first five abdominal segments have parallel sides, but second and third thoracic and last three abdominal segments have rounded or angular sides which are not parallel.

Adult:—Length, about one-third of an inch, breadth about one-fifth of its length, slender like the other Buprestid beetles belonging to the genus *Agrilus*. In color it is bronzy brown, shining, but with the surface granulated and punctured.

Both larva and adult have the appearance shown in figure 11.

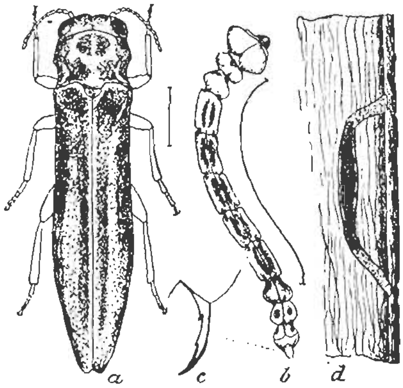

Figure 11. Sinuate pear borer. *a*, adult beetle; *b*, larva; *c*, anal fork of larva; *d*, pupal cell in solid wood—all enlarged. (After Smith, Report New Jersey Agricultural Experiment Station for 1894.)

CONTROL MEASURES.

All trees infested to such an extent that their value has been destroyed should be cut and burned. The worst infested branches or portions of a tree may also be pruned off and burned. In certain cases the pupal chamber as indicated by the sunken and discolored area may be cut open and the insect destroyed with the knife.

If the foliage be kept covered with arsenate of lead during the latter half of May and June, no doubt many of the adults will be killed in feeding upon the leaves.

Possibly washes of lime-sulphur and arsenate of lead applied to the bark before the beetles emerge may repel them so that they will seek other trees on which to oviposit, but this cannot be ascertained except by a long series of careful experiments.

The trees should be well fertilized and kept in a vigorous and growing condition, as they will not be so soon overcome by the attacks of this insect.

LITERATURE.

Britton, W. E. Report Connecticut Agricultural Experiment Station for 1917, page 361.
Proceedings Twenty-seventh Annual Meeting, Connecticut Pomological Society, page 47, 1918.

Drew, George A. Proceedings Twenty-ninth Annual Meeting, Connecticut Pomological Society, page 104, 1920.

Felt, E. P. Report of State Entomologist of New York, 31, page 78, 1915.

Slingerland, M. V. and Crosby, C. R. Manual of Fruit Insects, page 230, 1914.

Smith, J. B. New Jersey Agricultural Experiment Station, Bulletin 109, page 13, 1895.
Ibid., Report for 1894, page 550.

Weiss, H. B. Journal of Economic Entomology, Vol. 7, page 251, 1914.

THE EUROPEAN CORN BORER.

Pyrausta nubilalis Hubner.

An account of this insect will be found in the Reports of this Station for 1918, page 316, and for 1919, page 170. Since the latter Report was published the infested areas have been extended by the discovery of new towns found infested in Massachusetts, New Hampshire and in New York.

Besides this additional territory in the United States, two new infested centers have been discovered in the Dominion of Canada, in Welland County, Ontario, and also in Elgin, Middlesex County, and a part of Oxford County in western Ontario.

SCOUTING IN 1920.

Early in 1920, we received from the Bureau of Entomology at Washington the record of shipments of broom corn imported from Austria a few years ago, and consigned to two broom factories in Connecticut, one at Thompsonville in the town of Enfield, and the other at New Hartford. On April 26, Messrs. Zappe and Walden visited New Hartford and examined the cornstalks and stubble in eight fields around the factory. On April 29 they visited Thompsonville and inspected ten cornfields in the vicinity of the factory. No traces of the European corn borer were found in either case.

Members of the department staff have during the year examined many corn fields in different parts of the state, and have investigated many complaints and reports regarding borers in corn. As a rule these reports apply to the stalk borer *Papaipema nitela* Guen., or to the corn ear worm *Heliothis obsoleta* Fabr. (See Report for 1919, pages 180 and 188 respectively) both of which were quite abundant in 1920 as well as in 1919.

So far the European corn borer has not been found in Connecticut, and none of the appropriation of $10,000.00 made by the

General Assembly for the suppression of this insect should it occur here, has been expended.

State Quarantine.

The Federal Horticultural Board established Quarantine No 43, against the European corn borer, under date of March 15, 1920. In the Report of this Station for 1918, page 323, was published the text of the first quarantine order issued by Connecticut under authority granted by Section 2106 of the General Statutes, the quarantine bearing the date of September 20, 1918. As this order applied only to shipments of corn from the infested section of eastern Massachusetts, and as portions of New Hampshire, New York and Pennsylvania had been found infested after the establishment of the quarantine, a revised order was issued as Quarantine Order No. 3, effective June 1, 1920, prohibiting shipments of plants liable to be infested from all known infested areas in the United States, as follows:—

State of Connecticut
Office of
Agricultural Experiment Station
New Haven, Conn.

Quarantine Order No. 3.

Effective June 1, 1920.

Whereas a very destructive insect, known as the European Corn Borer *Pyrausta nubilalis* Hubner, exists in certain portions of the States of Massachusetts, New Hampshire, New York and Pennsylvania, and threatens the corn growing industry of the country; and whereas there is grave danger that this insect may be brought into this State by the transportation of infested plants or parts of plants from the infested area:—

Therefore, pursuant to the provisions of Section 2106 of the General Statutes, it is hereby ordered that no corn on the ear, stover, or other parts of the corn plant, broom corn, including all the parts of the stalk, celery, green beans in the pod, beets with tops, spinach, rhubarb, oat and rye straw as such or when used in packing, cut flowers or entire plants of chrysanthemum, aster, cosmos, zinnia, hollyhock, and cut flowers or entire plants of gladiolus, and dahlia, except the bulbs thereof, without stems, shall enter Connecticut from the infested areas mentioned below, unless each shipment, car, box, bale, or package bear a valid certificate issued by an authorized Federal inspector, stating that the contents thereof have been examined and found free from infestation by the European Corn Borer. These restrictions do not apply to dry shelled kernels or cooked and preserved products, or products grown in non-infested territory passing through infested areas in transit.

Infested Areas.

Massachusetts: Barnstable, Bourne, Brewster, Dennis, Eastham, Falmouth, Harwich, Orleans, Provincetown, Sandwich, Truro, Wellfleet, Yarmouth, in Barnstable County; Amesbury, Andover, Beverly, Boxford, Danvers, Essex, Georgetown, Gloucester, Groveland, Hamilton, Haverhill, Ipswich, Lawrence, Lynn, Lynnfield, Manchester, Marblehead, Merrimac, Methuen, Middleton, Nahant, Newbury, Newburyport,

North Andover, Peabody, Rockport, Rowley, Salem, Salisbury, Saugus, Swampscott, Topsfield, Wenham and West Newbury in Essex County; Arlington, Bedford, Belmont, Billerica, Burlington, Cambridge, Carlisle, Chelmsford, Concord, Dracut, Everett, Framingham, Lexington, Lincoln, Lowell, Malden, Medford, Melrose, Natick, Newton, North Reading, Reading, Somerville, Stoneham, Sudbury, Tewksbury, Tyngsboro, Wakefield, Waltham, Watertown, Wayland, Weston, Wilmington, Winchester and Woburn in Middlesex County; Avon, Braintree, Brookline, Cohasset, Holbrook, Milton, Quincy, Randolph, Wellesley and Weymouth in Norfolk County; Abington, Brockton, Duxbury, Hanover, Hanson, Hingham, Hull, Kingston, Marshfield, Middleboro, Norwell, Plymouth, Pembroke, Rockland and Scituate in Plymouth County; Boston, Chelsea, Revere and Winthrop in Suffolk County.

New Hampshire: Kingston, Plaistow and Seabrook in Rockingham County.

New York (Eastern): Albany, Cohoes, Colonie and Guilderland, in Albany County; Johnstown and Perth in Fulton County; Amsterdam, Florida and Mohawk, in Montgomery County; Brunswick, North Greenbush and Troy, in Rensellaer County; Ballston, Charlton, Clifton Park, Galway, Malta, Milton, Saratoga Springs and Stillwater in Saratoga County; Glenville, Niskayuna, Princetown, Rotterdam and Schenectady, in Schenectady County; Esperance in Schoharie County. New York (Western): Dayton, Perrysburg and Persia, in Cattaraugus County; Hanover, Pomfret, Dunkirk and Sheridan, in Chautauqua County; Brant, Collins, Cheektowaga, Eden, Evans, Hamburg and North Collins in Erie County.

Pennsylvania: North Girard in Erie County.

The regulations of this quarantine order are subject to modification to include additional territory, if such is found infested and in general will be interpreted as conforming to, rather than as being at variance with the regulations of the Federal Horticultural Board.

Quarantine order No. 1 relating to this insect, and issued September 20, 1918 is hereby revoked.

This order shall take effect June 1, 1920.

Approved.,
M. H. HOLCOMB,
Governor.

E. H. JENKINS,
Director Connecticut Agricultural Experiment Station.

Since issuing this Quarantine Order, No. 3, the following new towns have been found infested with the European corn borer:—

Massachusetts: East Bridgewater, Wareham, Whitman, Lakeville and West Bridgewater in Plymouth County; Canton, Dedham, Needham and Medfield in Norfolk County; Maynard, Westford, and Sherborn in Middlesex County; New Bedford in Bristol County.

New Hampshire: Hampton, North Hampton, Portsmouth and Rye in Rockingham County.

New York: Mayfield and Broadalbin in Fulton County; Glen and Charlestown in Montgomery County; Knox in Albany County; East Greenbush, Poestenkill and Schaghticoke in Rensselaer County; Duanesbury in Schenectady County; Middleburg, Schoharie and Wright in Schoharie County; Amherst, East Hamburg, West Seneca and Tonawanda in Erie County; Arkwright, Portland, Villenova, and Westfield in Chautauqua County.

The Federal Horticultural Board has issued four amendments to Quarantine No. 43, to cover these additional infested towns, the fourth bearing the date of October 23, 1920.

THE PEAR AND CHERRY SLUG.

Caliroa cerasi Linn.

The presence of brown slimy slugs or snail-like larvae is often noticed, feeding upon the upper surface of the leaves of pear and cherry. The green tissue may be eaten in patches or over the entire leaf, only the skeleton and lower epidermis remaining. Not infrequently small trees in nurseries and newly-set orchards are completely defoliated.

The author of this mischief is a small sawfly known as the pear or cherry slug, *Caliroa cerasi* Linn., sometimes listed as *Eriocampoides limacina* Retzius. It is an European species which feeds

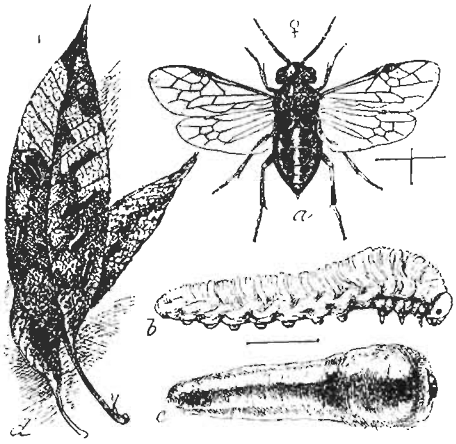

Figure 12. Pear and cherry slug. *a*, adult sawfly, female; *b*, larva with slime removed; *c*, larva in normal state; *d*, leaves and larvae, natural size; *a*, *b*, *c*, much enlarged. (After Marlatt, Circular 26, Division of Entomology, U. S. Department of Agriculture.)

upon a large number of different plants in Europe. It has been known in this country for more than two centuries but here attacks chiefly pear and cherry.

In Connecticut there are two generations each year, the eggs for the first being laid about the middle of May. The eggs are laid in the leaf from the under side, and by means of the ovipositor a cut is made between the lower epidermis and the upper epidermis, and also through the latter around the place where the egg is deposited. These cut places may be seen from the upper side and appear like small blisters. In each blister an egg is laid. The eggs hatch in about two weeks, and the young larva which is at first white, escapes through a crescent-shaped cut to the upper

surface and soon becomes covered with a brownish slime or coating which it carries until the last moulting stage. (See figure 13.)

The larva is much enlarged in the thoracic portion from which the abdomen tapers toward the tail giving it somewhat the appearance of a "bull-head" or tadpole. These brown slimy creatures are much wrinkled transversely, and present a very disgusting appearance. They pass through five stages: at the last moult, the brown slimy covering disappears and in the fifth or final larval stage, the slugs are yellow. They are now through feeding and soon go into the ground two or three inches and make cells in the soil in which they transform within six to eight days. The adults emerge in about ten days and soon lay eggs for the next generation. A part of the first-brood larvae do not transform but remain unchanged in their cocoons in the soil until the following spring. The eggs for

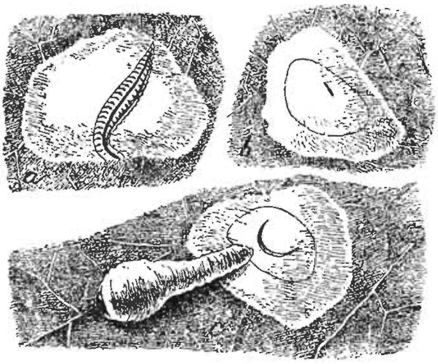

Figure 13. Pear and cherry slug, showing method of ovipositing and emergence of larva: *a*, cutting of cell with ovipositor beneath epidermis; *b*, the same after egg has been deposited; *c*, the same after emergence of larva—all enlarged. (After Marlatt, Circular 26, Division of Entomology, U. S. Department of Agriculture.)

the second brood are laid in July and August, and it is this brood which causes most of the injury in Connecticut.

Though there are usually two generations each year in the northern states, there are said to be three generations in the latitude of Washington, D. C.

This species is parasitzed by a minute four-winged fly, but so far as known this parasite has not been reared in Connecticut.

The adult of the pear and cherry slug is a small sawfly, 6 mm. in length, with black head, body, legs and antennae. The wings are smoky with black veins. (See figure 12.)

The specimens in the Station collection are from New Haven and South Windsor, but it is reasonably certain that the species occurs throughout the state. Larvae or characteristic injury have

been received from Hartford, West Hartford, Southington, Meriden, Wallingford, Norwich, Old Mystic, and South Norwalk. Our nursery inspectors have observed this insect in many other places in the state.

As regards remedies, spraying with lead arsenate will prove the most satisfactory in the nursery and orchard. The larvae may be killed, however, by spraying or dusting the leaves with fresh hellebore. Dusting with air-slaked lime or even with fine road dust will suffocate many of them.

LITERATURE.

MacGillivray, A. D., Bulletin 22, Connecticut Geological and Natural History Survey, page 77, 1916. (Key to species.)

Marlatt, C. L., The Pear Slug, Circular No. 26, Division of Entomology, U. S. Department of Agriculture, 1897. (Full illustrated account.)

Slingerland, M. V., and Crosby, C. R., Manual of Fruit Insects, page 214, 1914. (Brief illustrated account.)

THE CURRANT STEM GIRDLER.

Janus integer Norton.

A brief account of this insect appeared in the Report of this Station for 1896, page 238, recording its occurrence in Windham in that year. But as this Report has long been out of print, and as the insect has been observed many times and in many places since, it is mentioned here. It was also received from Meriden in 1920. Mr. Zappe examined a currant patch at Norwood, Hamden, on June 6, where nearly every twig had been severed by this insect.

The adult is one of the sawflies (Order Hymenoptera) and a slender species about half an inch in length. Both sexes have black head and thorax. The male has a brownish-yellow abdomen, but basal half of the female abdomen is reddish-orange and distal or posterior half, black.

The female punctures the soft tender shoot of the currant, by means of a saw-toothed ovipositor, and places a yellowish egg in the pith. This egg is elongated oval in shape. Above the egg the shoot is girdled by means of a series of transverse cuts with the ovipositor. The girdling usually occurs about three-fourths of an inch above the egg, but the distance may vary from half to an inch.

The stem is usually not cut entirely, but wilts and soon breaks off, leaving the stubs. Some of the tips break off and fall at once. The injury is shown in figure 14, and on Plate XII, a.

The egg hatches in about eleven days, and the larva feeds on the pith, excavating a tunnel seldom over six inches long, and packing if full of excrement in the rear. About the first of September the

larva becomes full grown, hollows out the lower end of its burrow, and gnaws its way outward to the bark. In this enlarged chamber, the larva encloses itself in a silk cocoon in which it passes the winter. In the spring the larva changes to a pupa and the adult emerges during the latter half of May. The adult, larva and pupa are shown in figures 15 and 16.

Figure 14. Currant stem girdler: *a*, egg puncture; *b*, section of stem showing egg in pith; *c*, severing of terminal shoot by female; *d*, egg — greatly enlarged. (After Marlatt, Insect Life, vols. vi and vii, Division of Entomology, U. S. Department of Agriculture.)

This insect was first described in print by Norton* under the name of *Cephus integer* in 1861, but the following year Fitch† published a description of the same species under the name of *Janus flaviventris*. Writers have used the name of *Phylloecus integer* and *P. flaviventris*, but according to the rules of priority

*Proc. Boston Soc. Nat. History, Vol. VIII, p. 224.
†Seventh Rept. on Insects of New York, p. 852.

Norton's name stands, and from the latest accepted scheme of classification, the insect belongs in the genus *Janus*.

In Connecticut this insect has been collected or observed in Windham, Canaan, New Haven, Hamden, Cheshire, Meriden, New London, Greenwich and Hartford. Undoubtedly it occurs throughout the state.

The currant stem girdler is probably a native of North America where it formerly bred in wild currants. Now it attacks the cultivated species, especially *Ribes rubrum*, often causing considerable injury. In nurseries and where the wood is used for

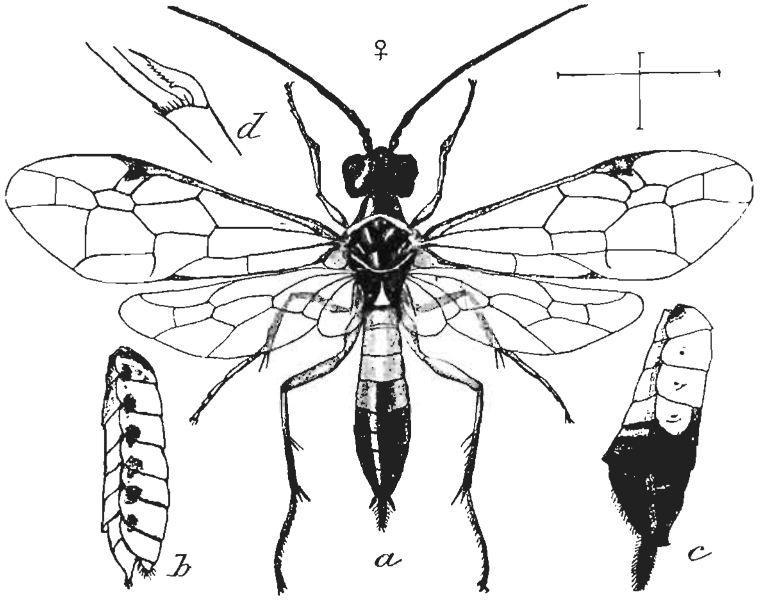

Figure 15. Currant stem girdler: *a*, adult female; *b*, lateral view of male abdomen; *c*, lateral view of female abdomen; *d*, apex of anterior tibia of female—all greatly enlarged. (After Marlatt, Insect Life, vols. VI and VII, Division of Entomology, U. S. Department of Agriculture.)

cuttings the insect is considered more of a pest than in fruiting plantations.

About the only remedial measures to be recommended are those of gathering and burning the tips containing the insect. If the girdled canes are cut back one or two inches in June, the tips will drop to the ground, soon become dry and the newly hatched larvae will be destroyed. Failing to do this, the tips of the infested canes can be gathered and burned in the fall or early spring. If these measures are practiced thoroughly for a few seasons, the injury will be much lessened.

LITERATURE.

Britton, W. E., Currant Stem Girdler, Report of Connecticut Agricultural Experiment Station for 1896, page 238. (Brief illustrated account.)

MacGillivray, A. D., Bulletin 22, Connecticut Geological and Natural History Survey, page 172, 1916. (Keys for separating the species.)

Marlatt, C. L., The Currant Stem Girdler, Insect Life, Vol. VII, page 387, 1895. (Illustrated account.)

Norton, Edward, Proceedings Boston Society of Natural History, Vol. VIII, page 224, 1861. (Original description of adult.)

Slingerland, M. V., The Currant Stem Girdler, Bulletin 127, Cornell Agricultural Experiment Station, pages 41-53, 1897. (Full illustrated account.)

Slingerland, M. V., and Crosby, C. R., The Currant Stem Girdler, Manual of Fruit Insects, page 357, 1914. (Brief illustrated account.)

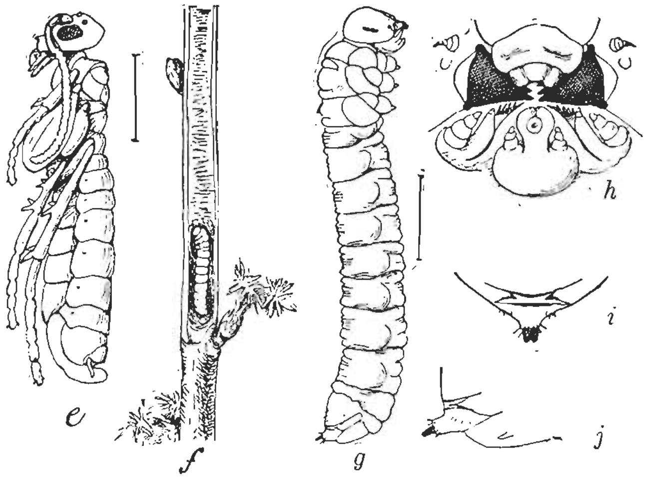

Figure 16. Currant stem girdler: *e*, pupa; *f*, larva in twig; *g*, larva; *h*, mouthparts of larva; *i*, dorsal view of tip of abdomen; *j*, lateral view of same—all enlarged. (After Marlatt, Insect Life, vols. VI and VII, Division of Entomology, U. S. Department of Agriculture.)

THE CELERY CATERPILLAR OR FENNEL WORM.

Papilio polyxenes Fabr. (*asterias*).

A yellowish-green caterpillar, more or less prominently marked cross-wise with black is often seen feeding upon the leaves of celery, carrots, parsnip, parsley, fennel, or in fact almost any plant of the family Umbelliferae. Though never very abundant, one often

finds several of these caterpillars on a short row in the garden. Sometimes they are quite destructive to young plants, especially celery.

Few observers recognize this caterpillar as the larva of the common black swallow-tail butterfly which may be seen here and there, everywhere, at certain periods of the season.

The eggs are one millimeter in diameter, globular, smooth, and yellow changing to reddish-brown. They are laid on the upper side of the leaves of the host plants, and hatch in about ten days. At first the young caterpillar is black with the rear end white, and a white band across the middle, but it moults five times and after each moult has a somewhat different appearance. When fully grown it is about two inches in length, green with the front margin of each segment black enclosing six yellow spots. When disturbed, this caterpillar pushes out from the prothorax just back of the head, two hornlike scent organs and a disagreeable odor may be noticed. These organs are probably for defense. The appearance of the caterpillar is shown on Plate XI, a.

A period of between three and four weeks is required for the larva to reach maturity and during this time it devours its food plant. Then it suspends itself to a leaf, stem, fence or other object of support which happens to be in the vicinity. The pupa is brown marked with black and dark green and is attached by a button of silk at the tail and by a girdle around the thorax. The insect remains in this state from nine to sixteen days, except when formed late in the season when it passes the winter.

The butterfly has a wing-expanse of between three and four inches, the female being usually larger than the male. Both pairs of wings are black crossed near the outer margin by two rows of yellow spots and a row of yellow lunules on the margin. A broad bluish band occurs between the rows of yellow spots on the rear wings and this color even extends faintly upon the rear margins of the fore wings. As a rule the blue band is more prominent in the female, and the yellow is more pronounced in the male, often appearing as solid bands on the rear wings, but great variations occur. At the inner angle of the rear wings there is an orange spot with a black center. Each of the rear wings bears a black tail-like appendage. Thorax and abdomen are black, marked with yellow spots. Plate XI, b, shows the appearance of this butterfly.

There are two generations in the northern states and at least three in the South. In the North the butterflies emerge in May and June from over-wintered pupae.

The species occurs throughout North America from southern Canada into South America as far as Venezuela and also in the West Indies.

Regarding control measures, hand picking is the usual and best method for the home garden. In large fields of carrots or parsnips where the tops are not to be eaten or fed to domestic animals,

spraying or dusting with lead arsenate may be practised in case the insect appears in great numbers.

LITERATURE.

Chittenden, F. H., Insects Injurious to Vegetables, page 179, 1907.

Comstock, J. H. and A. B., How to Know the Butterflies, page 62, 1904.

Crosby, C. R. and Leonard, M. D., Manual of Vegetable-Garden Insects, page 186, 1918.

Holland, W. J., The Butterfly Book, page 314, 1900.

Scudder, S. H., Butterflies of the Eastern United States and Canada, Vol. II, page 1353, 1889.

THE GRAPE BERRY MOTH.

Polychrosis viteana Clemens.

The chief cause of wormy grapes in Connecticut is this insect which occurs in the eastern portion of the United States and Canada, and westward as far as Illinois. The berries in a cluster are often webbed together, caused by the second-brood larvae leaving one set of berries and going into another. In some New York vineyards injuries are recorded which amount to a loss of from 25 to 50 per cent. of the total crop. In one case even 90 per cent. of the crop was ruined.

The grape berry moth undoubtedly occurs throughout the state; it has been sent to the Station from Sharon, Norwich, Mystic, Clinton and New Haven. It is a native American species and probably infested the wild grapes in this country before any vineyards were planted.

The adult is a small moth, having a wing-spread of slightly less than half an inch, of purplish-brown color, the fore wings marked or mottled with patches of darker brown. Rear wings are smoky-brown shading to whitish at the base.

In New York State the grape berry moth has two complete generations and a partial third one, the winter being passed in the pupa state on the old leaves on the ground. In making this cocoon portions of the leaves are cut and the edges rolled over and a silken case is formed inside the roll.

The moths emerge the first half of June and are thought to lay their eggs on the stems of the blossom clusters. Be this as it may, the first brood of caterpillars are at work at the time the grapes blossom, and make a scanty web among the blossom buds, and feed somewhat upon the buds often destroying a dozen or more in a cluster. They continue to feed during the month of June and also destroy many of the newly-set berries. The caterpillars of the first brood become mature soon after July 1, and make their cocoons by rolling up flaps of the leaves as has been described above. In a period varying from twelve to fourteen days the moths emerge

leaving their empty pupa shells projecting from the cocoons. They soon lay eggs on the berries or perhaps some of them on the stems, and the larvae of the second brood gnaw their way into the berries, usually entering near the stem or where two berries touch each other. The infested berries show a dark reddish spot around each entrance hole, and as the larvae feed inside the berries these spots enlarge until perhaps half the berry is discolored. (See Plate XII, b).

The young larva is whitish, with a blackish head, but as it grows the body changes to a dark olive green or brownish color, and often a purplish tinge is apparent. Thoracic shield and legs also become blackish. The larva is active and when disturbed wriggles out of the berries and spins down on a silken thread. The feeding period in the berries lasts about three weeks.

According to Goodwin* two thorough sprayings at the right time and with the proper materials will control this pest and ensure fruit nearly free from infestation. He recommends a Bordeaux mixture made after the 2-3-50 formula, to which four pounds of paste arsenate of lead and two pounds of dissolved soft soap have been added. The first treatment should be made just after the vines blossom, when the young berries are about one-eighth of an inch in diameter. The second application should be made about seven weeks after the first, or just before the eggs have been laid for the second-brood larvae. In Ohio this comes between August 2 and 12, but the exact time may be determined for each locality by placing in a jar about July 20, some wormy grapes with grape leaves on top of the berries: a piece of cheese cloth should be tied over the top of the jar and the jar placed out of doors in the shade. The spray should be applied ten days after the larvae first begin to make their cocoons on the leaves, and for this application six instead of four pounds of paste arsenate of lead should be used.

The vineyard should be intelligently pruned, cultivated, fertilized and sprayed properly for the other insect and fungous pests in order to produce a perfect crop.

LITERATURE.

Goodwin, W. H., The Grape-Berry Worm, Bulletin 293, Ohio Agricultural Experiment Station, 1916. (Full illustrated account.)

Gossard, H. A., and Houser, J. S., The Grape-Berry Worm, Circular No. 63, Ohio Agricultural Experiment Station, 1906. (Good illustrated account.)

Slingerland, M. V., The Grape-Berry Moth, Bulletin 223, Cornell Agricultural Experiment Station, 1904. (Full illustrated account.)

Slingerland, M. V., and Crosby, C. R., The Grape-Berry Moth, Manual of Fruit Insects, page 430, 1914. (Brief illustrated account.)

*Bulletin 293, Ohio Agricultural Experiment Station, 1916.

MOSQUITO WORK, SEASON OF 1920.

BY S. T. SEALY.

During the season of 1920, a constant patrol has been maintained on all of the drained salt marsh areas in the towns of Fairfield, Orange, New Haven, East Haven, Branford, Guilford and Madison, an approximate total of 5,000 acres. This means that at no time have the drainage ditches been allowed to become clogged or choked for any appreciable length of time. This patrol has kept the water in circulation and the surface drained, thereby reducing mosquito breeding to a minimum. It has also shown the need of supplementary ditches, which we have installed, to take off water which the original ditching did not fully care for.

Except for a few high tides in the fall, the season as a whole has been comparatively dry, making conditions somewhat better for mosquito elimination work than in previous wet seasons.

The mosquitoes which have been most troublesome this season have come, not from the drained marshes, but from adjoining ones where no drainage ditches have been installed, and from the "rain barrel" mosquito which breeds in any standing water about dwellings or in inland pools.

The writer states this as a fact, since he has made it a point to spend one day each week with the men doing the maintenance work in the different towns. At no time has any intensive breeding been found on drained areas. As soon as surface breeding was located it was immediately drained to the nearest ditch.

FAIRFIELD.

The work at Fairfield has been carried on by Mr. Nicholas Matinck with an average crew of two men to assist him. As Mr. Matinck has been engaged in this kind of work for the past few years, his efficient methods have made the Fairfield marshes almost mosquito proof. In addition to the salt marsh work the town officers of Fairfield have authorized and paid for, from town funds, considerable work in the upland sections; such as oiling, draining, and cleaning fresh water streams, brooks, ponds, etc.

NEW HAVEN, EAST HAVEN, ORANGE.

In the towns of New Haven, East Haven and Orange, a crew of four men, part of the time and two men the remainder of the time, have been at work keeping the ditches clean, the outlets free and the water in circulation. This crew started at West Haven and worked around the harbor to East Haven, going over the same route when the circuit was completed.

The tide gates constructed by the City of New Haven at Congress Avenue Bridge have been completed and are doing excellent

work. The marsh north of the gates has been dry all the season, thereby eliminating the breeding of salt marsh mosquitoes on this area.

BRANFORD.

The work at Branford has been under the direct supervision of Mr. L. E. Rice. The defective tide gates at Indian Neck have kept the marsh in a very wet condition causing a small amount of breeding in the upper end of the swamp. These gates will be put in repair as soon as it is determined what the state is going to do in regard to road and bridge; as gates are now hung on the bridge it would not be practicable to repair them at present.

A sand bar has formed at the mouth of the creek below the gates, stopping the flow of water. It is planned to remove this obstruction next season.

GUILFORD.

Mr. Frank Blatchley has patrolled and maintained the marshes of Guilford in perfect condition. He also repaired the tide gate at Shell Beach, which was damaged by last winter's storms.

MADISON.

The State Park Commission has maintained the ditches on the state property in good shape and hundreds of feet of new ditches have been installed for mosquito drainage by Mr. Joseph P. Synnott, who was in charge of the work for the Commission. Only a few days this season have visitors at the State Park been annoyed by mosquitoes, and then only when the prevailing winds have been from the east, blowing hordes of mosquitoes over from Clinton.

Mr. Russell Bartlett has had charge of the work in Madison that was not controlled by the Park Commission, and has maintained the marshes in excellent condition. The most trouble was along the beach caused by sand filling the main outlet ditch; this sand had to be dug out very frequently.

NEW WORK.

On June 4, 1920, a contract was let to Eaton, Brown & Simpson, Inc., 90 West Street, New York City, to drain for mosquito elimination sixty acres at Groton Long Point, Connecticut. They installed 28,000 feet of 8 x 20 ditch and built a bridge over the main outlet to the bay, for the sum of $1,000.00, three-quarters of which was subscribed by the members of the Groton Long Point Association.

As there are no other marsh lands in the near vicinity of Groton, the inhabitants are not likely to be troubled with mosquitoes from now on.

On September 14, 1920, at the request of Mr. J. Frederick Jackson, Director Bureau of Engineering, State Health Depart-

ment, an inspection was made at Lydall's Brook, Manchester, Conn. Light breeding was found in Union Pond and along the brook as far as Fould's Paper Mills. The settling tanks used to catch the waste water from the mills were found to be prolific breeders of mosquitoes (*Culex pipiens*). When these tanks overflow into the brook, the larvae are scattered along all the way to Union Pond, causing the people in the near vicinity to be pestered by mosquitoes. The State Department of Health is working on this matter, and will very likely plan some way to abate this nuisance.

COST OF MAINTENANCE AND NEW WORK, SEASON 1920.

Maintenance:	Madison	$265.63
	Guilford	578.14
	Branford	376.90
	East Haven	68.42
	New Haven	386.95
	Orange	474.66
	Fairfield	1,397.76
		$3,548.46
New Work:	Groton	250.00
Supervision*		2,401.43
Total		$6,199.89

MISCELLANEOUS INSECT NOTES.

Stalk Borer:—The stalk borer *Papaipema nitela* Guen., was present and ruined an occasional stalk of corn and potatoes, but was not nearly so prevalent as in 1919. Specimens were received from Danbury, Ridgefield, Derby, Milford, West Haven, New Haven, Hamden, New Hartford, Middletown and Hartford.

The Bud-Moth Injuring Apples:—One species found injuring the mature fruit in the orchard of Mr. William F. Platt, Milford, was the bud moth *Tmetocera ocellana* Schiff. The dark brown larva occurred with other leaf-rollers, several species of which were feeding upon the surface of the fruit.

Green Clover Worm:—The green clover worm *Plathypena scabra* Fabr., which was so prevalent in 1919 causing injury nearly everywhere throughout the eastern United States, did not injure beans at all in Connecticut in 1920. By making a thorough search in my own garden, I managed to find a few larvae, but the feeding which they did was unnoticeable.

Pine Tube Moth:—The pine tube moth *Eulia pinatubana* Kearfott, mentioned on page 201, and shown on Plate XXXII, of the Report of this Station for 1919, was reported as being rather

*Supervision includes salary and traveling expenses of Deputy in Charge, first cost, insurance and upkeep of automobile.

abundant around Stamford in 1920. Late in the fall three samples were received from Norwalk, Sound Beach and Stamford. If ornamental pines are infested sufficiently to endanger their foliage, or even their appearance the trees should be sprayed with lead arsenate.

Periodical Cicada or Seventeen-Year Locust:—Brood II of this interesting insect was scheduled to appear in 1920 in Suffield and in Tolland, Conn. Several correspondents and entomologists were warned to watch for it, and though they did so, the reports were all negative. I have yet to learn of anyone who collected or observed this insect in Connecticut in 1920.

Corn Ear Worm:—The corn ear worm *Heliothis obsoleta* Fabr., was received from Mystic, Milford, Middlebury and New Canaan. In one field in Mystic about half the crop was damaged. This insect usually attacks late maturing corn, especially sweet corn, and feeds on the soft kernels chiefly at the tips of the ears. Sometimes it works down the side of the ear and eats some of the kernels near the base. It is a much more serious pest farther south than it is in Connecticut. In New Jersey it is controlled by dusting the corn silk with powdered sulphur and dry lead arsenate, equal parts.

Sesiid Borers:—On July 1, 1920, Mr. Zappe visited a garden at 260 Howard Avenue, New Haven, and found apple trees infested with Lepidopterous larvae boring in the branches and doing considerable damage. Some material was brought to the laboratory, and on July 16, an adult clear-wing moth emerged. This proved to be *Sesia pyri* Harris, a species having a wing expanse of less than three-fourths of an inch, and transparent wings with black margins. It rarely causes serious injury, as the larva burrows in the bark but does not penetrate the sapwood.

A similar borer was received, June 11, from the Elm City Nursery Company in a stem of Rhododendron. On June 23, the adult emerged. It is a similar though different species from the preceding, but has not yet been identified.

Oriental Peach Moth:—No larvae of this insect could be found in 1919 by Mr. Zappe, at the place where it infested peach fruits in 1918 near Stamford (see Report of this Station for 1918, page 299) and on June 20, 1920, Messrs. Zappe and Britton in company with Mr. W. O. Filley, Forester of this Station, and Mr. F. A. Bartlett of Stamford, visited the same premises. It is true that some of the trees had died and had been removed and others had been severely pruned. Though there was little fruit to become infested, we examined the twigs of several trees and found no signs of injury. Doctor T. J. Headlee informs the writer that the Oriental peach moth has been unusually destructive in New Jersey the past season.

Red Banded Leaf-Roller:—In harvesting and scoring the fruit in the experiments in dusting and spraying in the orchard of Mr. William F. Platt, Milford, described in the preceding pages of this Report, many of the apples were gnawed on the surface, especially where covered by a leaf or another apple, and in some cases in the stem or calyx cavities. At least three insects were responsible for this injury: (1) the bud moth mentioned on page 176, (2) the lesser apple worm, *Enarmonia prunivora* Walsh, and (3) the red banded leaf-roller *Eulia velutinana* Walker. The last seemed to be the most abundant and the injury was apparently done late in the season. The injury shown on Plate VI, a, was sufficiently serious to warrant another and later treatment to prevent it.

Juniper Scale:—On August 4, 1917, a twig of common red cedar *Juniperus virginiana*, infested with the juniper scale *Diaspis carueli* Targ.-Tozz., was received from Danbury. On March 11, 1920, Mr. A. S. Peterson, New Rochelle, N. Y., sent to the Elm City Nursery Company a branch of a cultivated juniper *Juniperus pfitzeriana*, well infested with this scale. It is a scale with shell nearly circular, and occurs on the leaves sometimes in great numbers, as is shown on Plate XIII, b. The female shell is very convex, gray or dirty white, often covered with a sooty deposit. The male is small, elongated, narrow with parallel sides, with a median ridge or carina, and white in color.

Apparently little is known regarding the life history of this insect, or how best to hold it in check. Probably it will do little harm to trees in their native habitat, but should it infest choice ornamental specimens, it can doubtless be controlled by several applications between June 1 and September 1, of either kerosene emulsion, or nicotine solution and soap, given in the form of a spray.

The Elm Leaf-Miner:—On June 14, elm leaves were received from Miss Charlotte B. Norton, Lakeville, Conn., which showed the characteristic mines and feeding injury of a sawfly known as the elm leaf-miner *Kaliofenusa ulmi* Sundewall. More material was requested and received a few days later. This was placed in the breeding cages and possibly next summer some adults may be obtained. The larvae are miners between the upper and lower epidermal layers of the leaves, and frequently there are several larvae in a leaf and the mines run into each other making a large blister, sometimes involving the entire leaf. These blisters are very conspicuous, showing almost as plainly from beneath as from above, and have the appearance indicated by Plate XIII, a. The badly injured leaves drop, but those slightly injured remain upon the tree, the mined areas falling out leaving holes. In aggravated cases trees are nearly defoliated by July 1, but later new leaves appear and the trees regain their normal appearance. Of course such attacks weaken the trees and render them very

unsightly. As is the case with the elm leaf beetle, the European species of elm are preferred tó the American elm.

This is the first evidence that the elm leaf-miner is present in Connecticut, though it has been known to injure elms in and around Albany*, N. Y., for more than twenty years. The adult is a small sawfly only three millimeters long, and the eggs are laid in the leaves during the latter half of May and June. There is only one brood each year.

A number of experiments in controlling this insect have been conducted by Professor G. W. Herrick† of Cornell University. He found that when a tree was sprayed thoroughly with 40 per cent. nicotine solution and laundry soap, just as the mines begin to show, all larvae were killed.

Ox Warbles:—On May 15, three larvae were received from Mr. B. K. Allen of Saybrook, with the statement that they had been squeezed from a cow's back. It is not unusual for cattle to have "grubs" under the skin on their backs. The infestation is most noticeable in late winter or early spring, and a series of lumps may be felt or often seen. These lumps increase in size and finally discharge their inmates which go into the ground to pupate and later emerge as two-winged flies, more or less covered with yellow hairs somewhat resembling bees. (See Plate XV, a.) These flies are known as "bot-flies" or "warble flies" and annoy cattle and horses in the pasture in summer, laying their eggs upon the hairs of the legs or body. The eggs are licked off by the animals and taken into the stomach where they obtain nourishment. The larvae of the horse-bot, *Gastrophilus equi* Clark, are attached to the wall of the stomach and when finally mature pass out of the animal with the excrement. But those in cattle make their way through the stomach wall and other tissues, finally reaching the skin upon the back. Two species, *Hypoderma bovis* DeGeer, and *H. lineata* DeVillers, are known to attack cattle and both occur in Connecticut. They cause considerable injury by annoying the animals, and "warbled" hides are much less valuable than perfect ones.

There is no good remedy. Grubs beneath the skin may be squeezed out or treated with mercurial ointment. Where possible it is advisable to keep the animals well cleaned and brushed and to prevent them from licking themselves.

A closely allied species, *Oestrus ovis* Linn., is the well-known sheep-bot, the larva of which infests the nasal cavities in sheep.

Other closely related species belonging to the genus *Cuterebra*, infest rabbits and are occasionally found in cats. On October 2, a

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*M. V. Slingerland, Cornell Agr. Expt. Station, Bulletin 233, page 50, 1905.

†*Ibid*, Bulletin 333, page 510, 1913.

large larva was received from Vernon, which had been squeezed from a hole through the skin on the side of a kitten six months old.

A Curious Form of Injury to Dahlias by the European Giant Hornet:—On September 21, two adults of the European giant hornet, *Vespa crabro* Linn., were received from Miss Emily Slocombe of 555 Townsend Avenue, New Haven, with a statement that these hornets had killed two dahlia plants and injured several more by eating off the bark. On September 25, Messrs. Walden and Garman visited the premises. They saw five or six large plants which had been badly chewed by the hornets as shown on Plate XIV, b. Seven of these large hornets were around one plant and seemed to return to it even after having been driven away. The sap oozed out of the injured plants, fermented, and many adults of the bumble flower beetle *Euphoria inda* Linn., were feeding upon the sour sap. It was suggested to the owner that the stems of the injured plants be sprayed with lead arsenate.

This insect has long been known to gnaw the bark from hard wood twigs often girdling them, but this is the first instance coming under our observation in which it has attacked herbaceous stems. A note regarding the giant hornet and its habit of girdling twigs may be found in the Report of this Station for 1916, page 144.

On October 9, specimens of the European giant hornet were received from Mr. E. Vanderwerken, of Stamford, who writes that Italians and Japanese both regard the species as a great menace to bee keeping, as the adults kill honey bees in great numbers. We have made no observations to confirm this statement.

This hornet is a native of Europe, and was first noticed around New York City some twenty-five years ago, from where it has spread gradually into Connecticut and throughout New Jersey.

It was first collected in Connecticut at New Haven, June 13, 1900, and specimens have been received at the office many times in recent years from Greenwich, Stamford, Darien, Plantsville, Hamden and New Haven. It is shown on Plate XIV, a.

Leaf-Roller on Tartarian Honeysuckle:—In the Report of this Station for 1918, page 342, mention is made of a larva feeding on Tartarian honeysuckle, from which was reared on July 18, a moth belonging to the genus *Harpipteryx* and apparently undescribed. The larvae were rather abundant in the writer's garden in 1920 webbing together and feeding upon the tender terminal leaves. Several adult moths were reared, emerging on July 1. A brief description follows:—

Larva.—15-18 mm. in length; 1.5 mm. thick at fifth abdominal segment, from which it tapers towards both extremities, the taper being greater though less abrupt toward the head: lateral and ventral surfaces leaf-green with a lighter blue-green stripe adjoining dark median stripe, and short diagonal lighter stripes above the spiracles: two longitudinal dorsal stripes, purplish to chocolate brown, separated only by a faint narrow line of lighter color. Head grayish-green, faintly marked and

mottled with light-brown, bearing brown hairs. Legs and prolegs green like dorsal surface; anal prolegs prominent. Each segment bears a number of short brown hairs or bristles. Wriggles like a Pyralid, and spins down on a silk thread.

Cocoon.—About 18 mm. in length; 3 mm. thick for two-thirds its length; tapering equally at both ends to a sharp point. Whitish or straw-color. Fastened to a leaf.

Adult.—Wing-spread 20-22 mm. Fore wings chestnut-brown with a conspicuous cream-colored rear margin: near the outer end of this marginal band there extends forward and outward a pointed streak of the same color ending just beyond the disk. Fore wings extended at tips and curved backward forming recurved hooks. A cream-colored dorsal patch on thorax extends over head and palpi: antennae filiform, whitish but annulated with brown or black. Rear wings blackish or smoky-brown with lighter fringe. Abdomen, legs and under surface colored about like rear wings.

Since rearing this moth in 1918, Doctor William Barnes has published* an illustration of an European species *Harpipteryx xylostella* Linn., which appears to be the same as our specimens. Some of our material was therefore sent to Doctor Barnes, who reports it to be the European species *H. xylostella.*

Illustrations of the larva, cocoon and adult may be found on Plate XV.

ILLUSTRATIONS.

All plates are from photographs from the following sources:—Plates IV, V, and X by W. E. Britton; Plate IX, b, and d, by M. P. Zappe; Plate IX, c, by K. F. Chamberlain; Plate XIII, b, by Philip Garman; all others by B. H. Walden. The text figures are from drawings as follows:—Figure 4, map drawn by A. E. Moss; Figure 5, plan of orchard experiments, drawn by E. M. Stoddard; Figure 6, by Philip Garman; Figures 8, 9, 10 and 11, after Dr. E. P. Felt, Cornell Extension Bulletin 27; Figure 11, after J. B. Smith, New Jersey Agricultural Experiment Station; Figures 12, 13, 14, 15 and 16, after C. L. Marlatt, Bureau of Entomology, U. S. Department of Agriculture.

*Contributions to the Natural History of the Lepidoptera of North America, Vol. IV, page 246, Plate XXVIII, figure 12, 1920.

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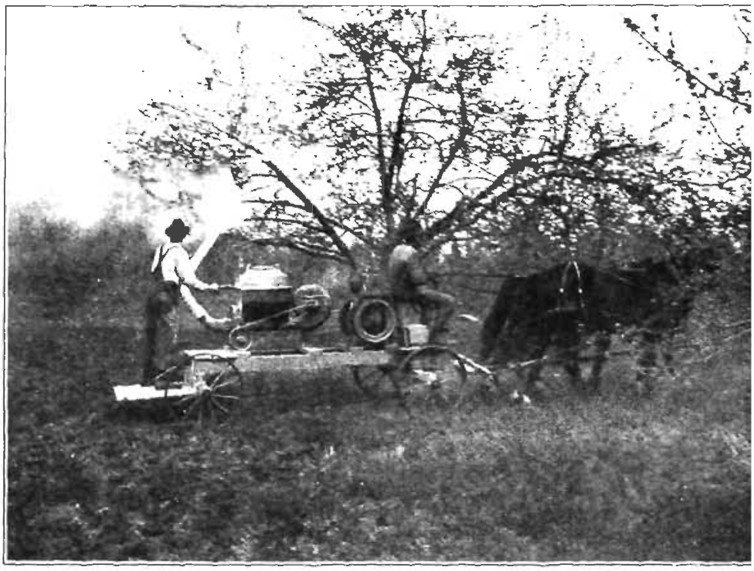
a. Front view of outfit.

b. Rear view.

DUSTING IN APPLE ORCHARD.

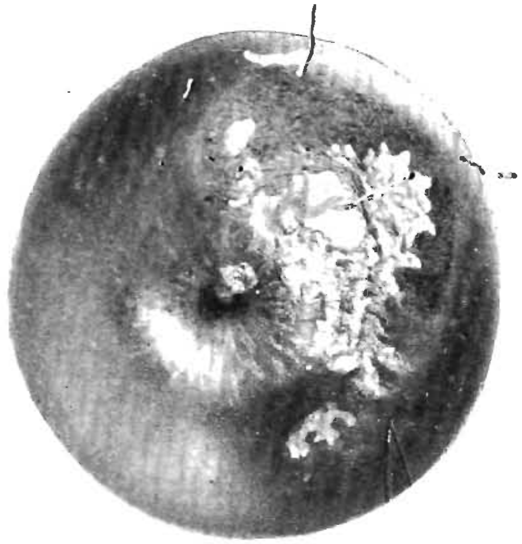
PLATE V.



a. Side view of dusting outfit.

b. Spraying outfit used in Platt's orchard.

DUSTING AND SPRAYING IN APPLE ORCHARD.



a. Work of red banded leaf-roller on fruit, natural size.

b. Spraying potatoes to kill aphids, at Woodmont.

INJURY TO APPLES: SPRAYING POTATOES.

a. Apple trees injured by the false red bug.
Leaves natural size, bug nearly three times enlarged.

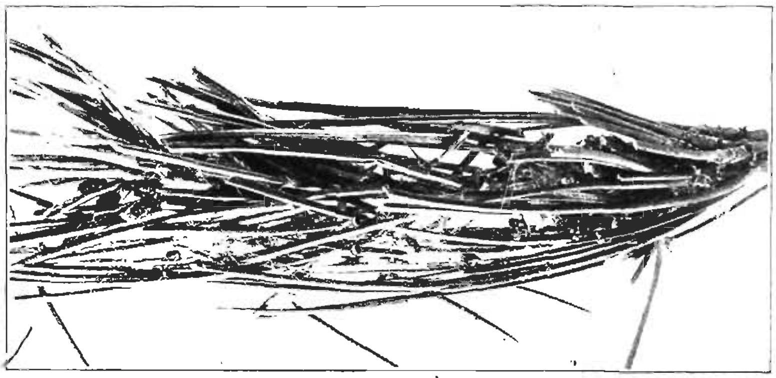
b. Half-grown apples showing red bug injury.

FALSE APPLE RED BUG.

a. Crescent-shaped eggs on developing needles, twice natural size.

b. Larva, twice natural size.

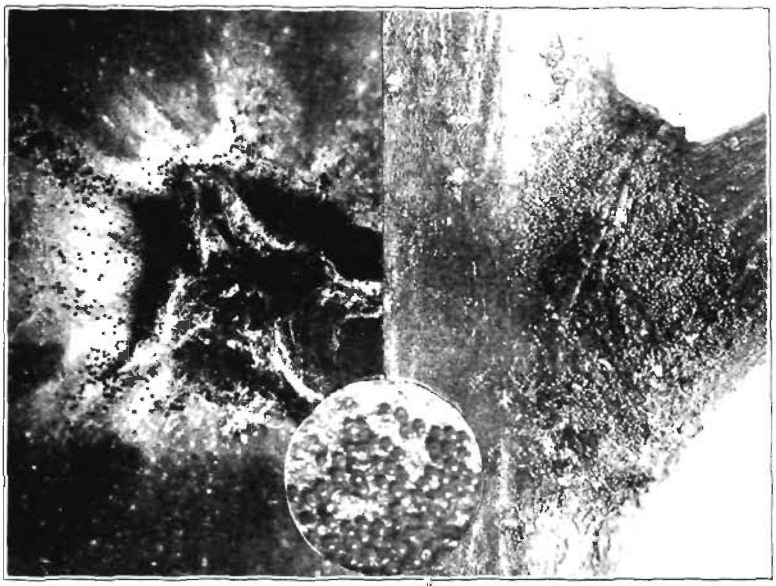
c. Larva feeding in cluster of needles, natural size.



d. Cluster of needles webbed together in characteristic fashion by the larva, natural size.

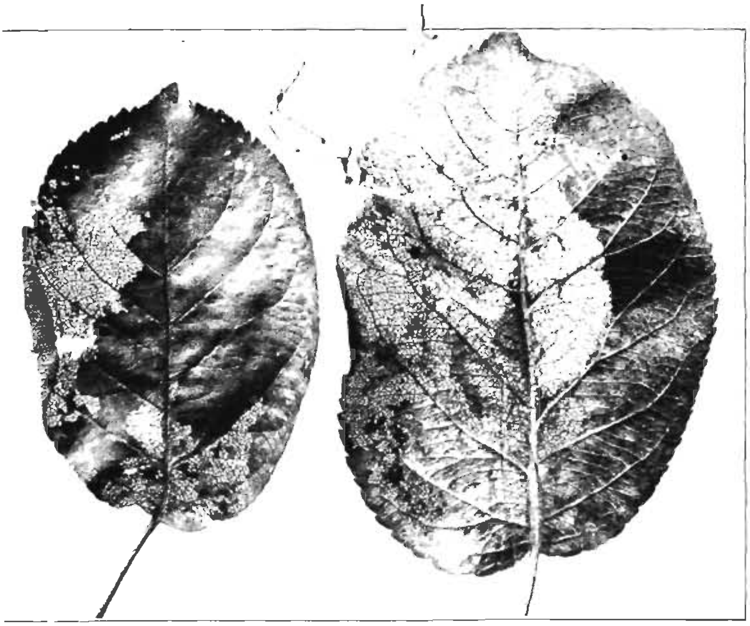
SAWFLY ON AUSTRIAN PINE.

a. Infested apple tree which has lost much foliage from the attacks of the mite.

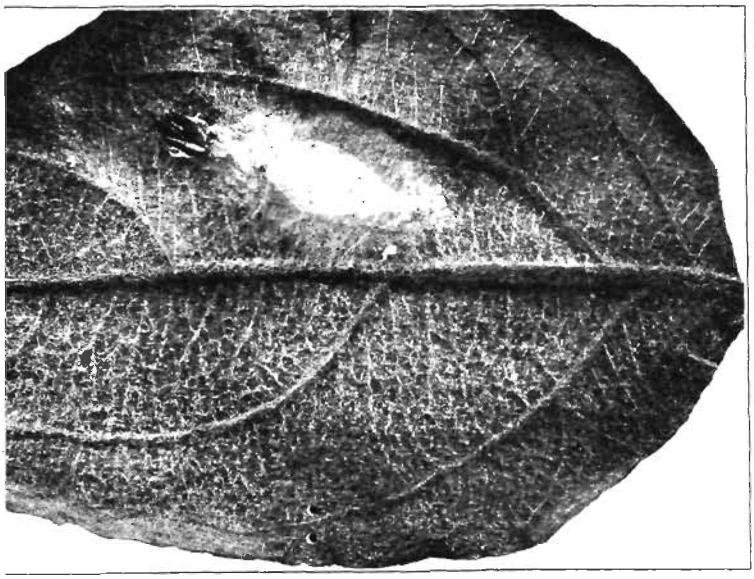


b. Eggs on calyx end of apple, and on twig, three times enlarged; insert, same from twig, enlarged about ten times.

EUROPEAN RED MITE.

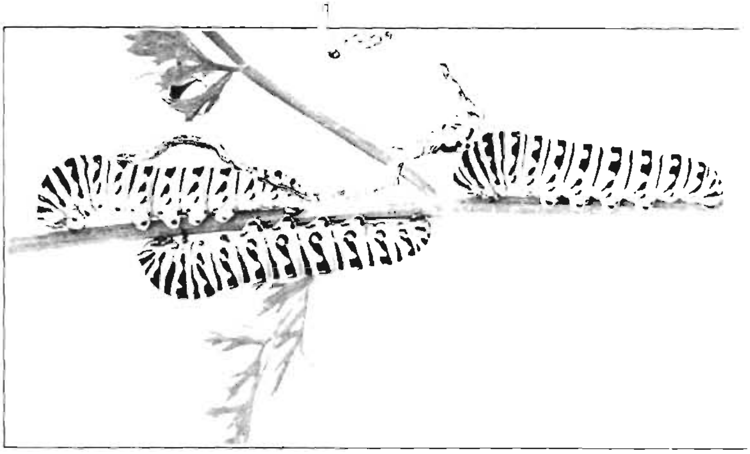


Characteristic injury of larvae on apple leaves, somewhat reduced.



b. Cocoon on under surface of apple leaf, twice natural size.

APPLE AND THORN SKELETONIZER.



a. Larvae feeding upon carrot, natural size.

b. Adult, known as the black swallow-tail butterfly; female, natural size.

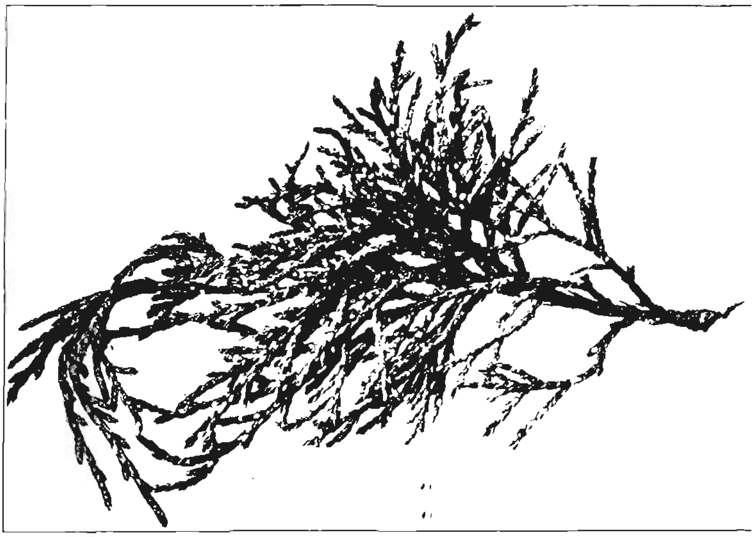
CELERY CATERPILLAR.

a. Work of currant stem girdler, in severing tip of new shoot. Egg is laid just below the cut. Natural size.

b. Cluster of grapes infested by larvae of the grape berry moth. Natural size.

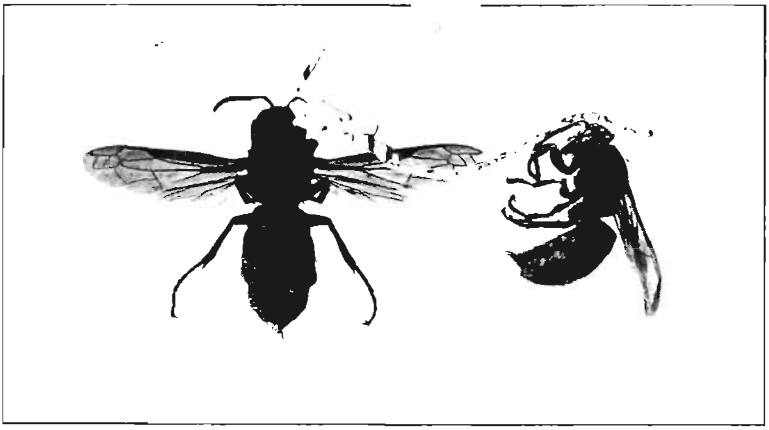
CURRANT STEM GIRDLER AND GRAPE BERRY MOTH.

a. Characteristic injury of elm leaf-miner, somewhat reduced.

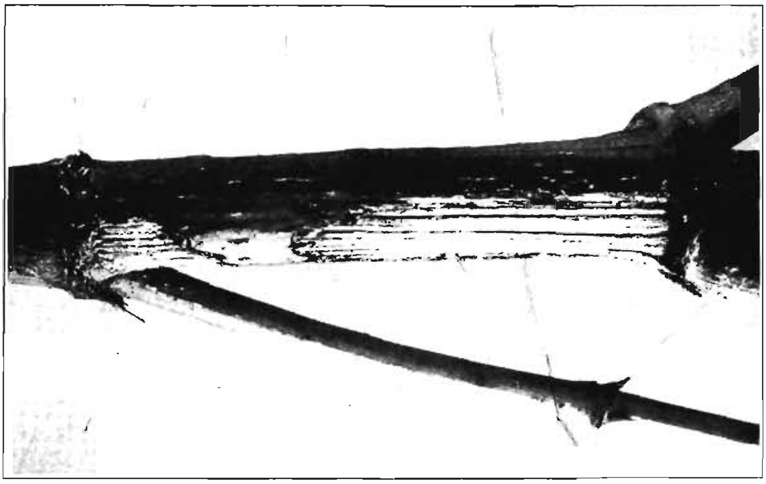


b. Juniper twig, showing scales on leaves, natural size.

ELM LEAF-MINER AND JUNIPER SCALE.



a. Adult hornets, dorsal and lateral views, natural size.

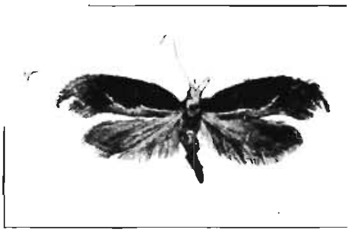


b. Dahlia stem gnawed by hornets, somewhat reduced.

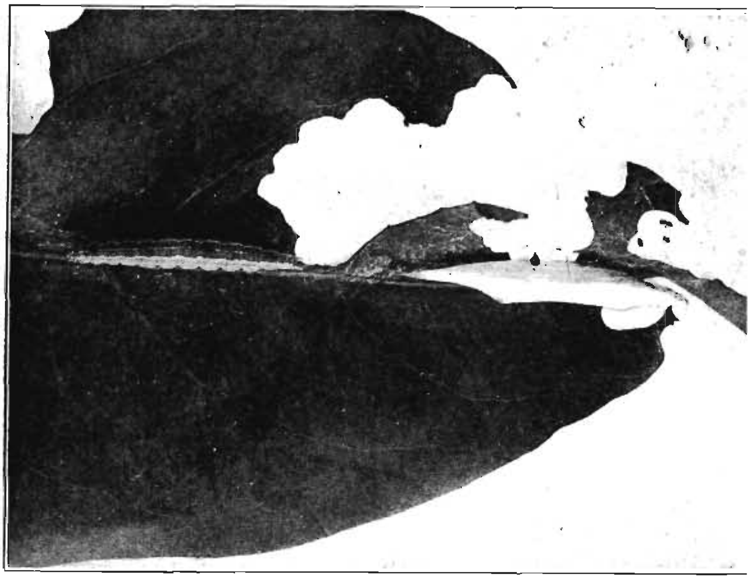
EUROPEAN GIANT HORNET.

PLATE XV.

a. Adult ox warble or bot fly, twice natural size.



b. *Harpipteryx xylostella*, twice natural size.



c. Larva and cocoon of *Harpipteryx xylostella*, twice natural size.

OX WARBLE OR BOT FLY, AND HARPIPTERYX ON TARTARIAN HONEYSUCKLE.

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 227 FEBRUARY, 1921

BEING THE

Twenty-Fifth Report

ON

Food Products

AND

Thirteenth Report on Drug Products.

By E. M. BAILEY.

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the editions permit.

DRUGS, ETC.

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The Twenty-fifth Report on Food Products and the Thirteenth Report on Drug Products, 1920.

BY E. M. BAILEY.

The inspection and analysis of foods, drugs and miscellaneous materials made by this station during the past year are presented in this report which marks the twenty-fifth year of food inspection and the thirteenth of drug inspection in this State. The study of methods for the determination of caffein, principally in tea, has been continued and a new proceedure devised for the rapid and accurate estimation of this constituent. An examination of laundry and toilet soaps has been made, and a number of new and interesting diabetic foods have been analyzed. A larger number than usual of alcoholic liquors have been tested, chiefly for wood alcohol, on account of the panic created by the sale of a quantity of "poison whiskey" the alcohol of which was found to be entirely methyl (wood) alcohol.

As for several years past the volume of work done for the Dairy and Food Commissioner has been relatively large. Milk, ice cream, carbonated beverages and drug preparations are the items of chief importance.

An exhibit showing different phases of the laboratory work was prepared as a part of the Station exhibit at the Farmers' Week Fair in Hartford; and a number of papers have been written for presentation at meetings of various associations.

Co-operation with the Association of Official Agricultural Chemists in the study of methods of analysis, with the American Medical Association on matters pretaining to diabetic foods and with the Society of Cotton Oil Chemists in the examination of check cottonseed meals and fertilizers has been continued.

Credit for the analytical work involved is due entirely to Messrs. Andrew, Shepard, Edmond, Nolan and Merwin. Mr. Andrew has shared with the writer much of the court work called for by the Dairy and Food Commissioner.

I. FOODS.

CARBONATED SOFT DRINKS, ETC.

One hundred and eighty-nine samples of soft drinks, cereal beverages, etc., have been submitted by the Dairy and Food Commissioner. They are grouped according to the examinations made of them as follows:

Examined for saccharin 131; saccharin detected in 53.
Examined for capsicum 44; capsicum detected or indicated in 43.
Examined for alcohol 14; alcohol found in excess of 0.5 per cent. in 10.

The presence of saccharin in any normal food constitutes adulteration in this State. Section 2438 of Chapter 128 of the General Statutes declares an article of food to be adulterated "if any substance has been mixed and packed with it so as to reduce or lower or injuriously affect its quality or strength." Also "if it contains any added poisonous or other added deleterious ingredient which may render such article injurious to health."

While beverages of the soda water type are not drunk primarily for their food value, they possess a food value by virtue of the sugars they contain. Saccharin has no food value but its sweetening power is about 500 times greater than that of ordinary sugar. The addition of saccharin necessarily reduces the food value of any article of food in which it is used as a substitute for sugar; and it is, moreover, a substance which may render food injurious to health.[1] In spite of the growing sentiment against this illegal sweetener among the better class of bottlers it is still used to a considerable extent in the State chiefly, if not entirely, by local establishments.

Saccharin was found in the following samples:

D. C. No.	Brand.		Manufacturer or Dealer.
15119	Strawberry Soda.	*Ansonia:*	Crystal Bottling Works.
17208	Lemon Soda.		G. Soventino.
17223	Cream Soda.	*Bridgeport:*	American Bottling Co.
17219	Cream Soda		Central New York Bottling Co.
17216	Cream Soda.		Gottlieb Luippold.
17221	Strawberry Soda.		Greater New York Bottling Co.
15123	Orange Soda.		Grey & Lights.
17231	Cream Soda.		Hallett Mineral Water Co.
17218	Cream Soda.		Standard Bottlings Works.
15122	Raspberry Soda.		West End Bottling Works.
17235	Raspberry Soda.		West End Bottling Works.
16188	Strawberry Soda.	*Bristol:*	Elco Beverage Co.
15385	Orange Soda.	*Danielson:*	H. B. Hargraves.

[1] Food Inspection Decision 142, U. S. D. A.

D. C. No.	Brand.		Manufacturer or Dealer.
16161	Strawberry Soda.	*Hartford:*	United Bottling Works.
16159	Strawberry Soda.		Anthony P. Zazzaro.
16160	Lemon Soda.		Anthony P. Zazzaro.
17779	Ginger Ale Soda.	*Jewett City:*	James Gloryacki.
17778	Strawberry Soda.		James Glorvacki.
17777	Ginger Ale Soda.		Peter Romanek.
17776	Strawberry Soda.		Peter Romanek.
17227	Cream Soda.	*Meriden:*	T. F. Lyons.
17205	Lemon Soda.	*Naugatuck:*	John Greene.
15596	Cream Soda.	*New Britain:*	S. F. Avery.
15593	Strawberry.		Eureka Bottling Co.
16152	Lemon Soda.	*New Haven:*	Atlantic Bottling Works.
16956	Ginger Ale Soda.		Clancy Bottling Works.
16952	Sarsparilla Soda.		Golden Eagle Bottling Works
16960	Ginger Ale Soda.		Hamilton Bottling Works.
16964	Lemon Soda.		Virginia Linauro Bottling Works.
16963	Soda.		Frank Mosca Bottling Works
16961	Lemon Soda.		New Haven Bottling Works.
15121	Lemon Soda.		Harry Owen.
16954	Cream Soda.		Shanbron Bottling Works.
17312	Ginger Ale Soda.		Smile Bottling Works.
17313	Cream Soda.		Smile Bottling Works.
16955	Orange Soda.		Yale Bottling Works.
18435	Ginger Ale Soda.	*Norwalk:*	Morris Slopshin.
18436	Strawberry Soda.		Morris Slopshin.
17244	Cream Soda.	*Norwich:*	D. A. Sullivan.
18438	Strawberry Soda.	*South Norwalk:*	Adolf Dreifuss.
17211	Lemon Soda.	*Stamford:*	Silver Springs Water Co.
17214	Strawberry Soda.		National Spring Water Co.
17329	Strawberry Soda.	*Stratford:*	George Bovodach & Steve Tomasco.
17330	Cherry Soda.		George Bovodach & Steve Tomasco.
18246	Strawberry Soda.	*Taftville:*	Albert LaBarre.
16191	Cream Soda.	*Thomaston:*	August Koegel.
15588	Strawberry Soda.	*Waterbury:*	Brass City Bottling Works.
15590	Strawberry Soda.		Brooklyn Bottling Works.
16200	Strawberry Soda.		J. A. Silver.
15390	Strawberry Soda.	*Willimantic:*	John Latusek.
16985	Lemon Soda.		John Latusek.
17201	Lemon Soda.		Mosca & Salvatore.
17203	Strawberry Soda.		Mosca & Salvatore.

Beginning January 1st, 1921, the presence of capsicum in ginger ale must be stated upon the label[1].

By official definition "ginger ale is the carbonated or artificially carbonated beverage prepared with potable water, acidulated sugar (sucrose) syrup, and ginger ale flavor," ginger ale flavor being the water-soluble product obtained from ginger, with or without flavoring substances which do not simulate the flavor or pungent effect of ginger.

"Ginger ale with capsicum is the carbonated or artificially carbonated beverage prepared with potable water, acidulated sugar (sucrose) syrup, and ginger ale with capsicum flavor," ginger ale with capsicum flavor being the water-soluble product obtained from ginger and capsicum, with or without other flavoring substances.

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[1]F. I. D. No. 177

The predominating flavor in both ginger ale and ginger ale with capsicum is that of ginger.

The beverage called ginger ale is said to have originated in England and the presence of capsicum in the formula appears to have been established by general use, its purpose being to add pungency to the product. Why the beverage should have been called ale is not apparent. It bears no resemblance to the product of that name prepared from malt and hops and is not fermented.

The method we have used for the detection of capsicum indicates the presence of capsicum or other pungent substances foreign to ginger[1]. By this method capsicum was indicated in the following samples:

D. C. No.	Brand.		Manufacturer or Dealer.
17222	Ginger Ale	*Bridgeport:*	American Bottling Works.
17215	Ginger Ale		Gottlieb Luippold.
17220	Ginger Ale.		Greater New York Bottling Co.
17232	First Prize		Grey & Light.
17230	Ginger Ale.		Hallett Mineral Water Co.
17217	Ginger Ale.		Standard Bottling Co.
17234	Ginger Ale.		West End Bottling Co.
17237	Ginger Ale.		Whistle Bottling Co.
16180	Ginger Ale.	*Bristol:*	Bristol Bottling Works.
16189	Ginger Ale		The Elco Beverage Co.
16186	Cascade		C. E. Perkins Bottling Works.
17252	Ginger Ale	*Central Village:*	U. LaFrance.
17250	Ginger Ale.	*Danielson:*	H. B. Hargraves.
16172	Ginger Ale.	*Hartford:*	Hartford Bottling Works.
17224	Hydrox.	*Meriden*	Charles N. Carroll.
17226	Sun Ray.		T. F. Lyons Co.
17204	Ginger Ale.	*Naugatuck:*	John Greene.
15597	Ginger Ale.	*New Britain:*	S. F. Avery.
15594	Ginger Ale.		Eureka Bottling Works.
15595	Ginger Ale.		William Naughton.
17242	Pequot Brand.	*New London:*	Bagdanowsky Bros.
16199	Ginger Ale.		Rich & Rubin.
17238	Ginger Ale.		Steam Bottling Works.
17247	Ginger Ale.		Chester Wright.
17243	Ginger Ale	*Norwich:*	Crystal Spring Co.
16183	Ginger Ale	*Portland:*	Portland Bottling Works.
17249	Ginger Ale.	*Putnam:*	Putnam Bottling Works.
17115	Ginger Ale.	*South Manchester:*	Manchester Bottling Works.
17213	Ginger Ale.	*Stamford:*	National Spring Water Co.
17210	Ginger Ale.		Silver Spring Water Co.
16190	Ginger Ale.	*Thomaston:*	August Koegel.
17228	Ginger Ale.	*Wallingford:*	R. S. Botsford.
16181	Ginger Ale.	*Middletown:*	Duchess Bottling Works.
15599	Arauna.		M. T. Fitzgibbons.
15587	Ginger Ale.	*Waterbury:*	Brass City Bottling Works.
15589	Ginger Ale.		Brooklyn Bottling Works.
16192	Ginger Ale.		Eagle Brewing Co.
16193	Ginger Ale.		Hamilton Bottling Works.

[1] A. O. A. C. Methods of Analysis, p. 206. 1919.

D. C. No.	Brand.		Manufacturer or Dealer.
16197	Ginger Ale.	*Waterbury:*	Mascola Bottling Works.
17209	Elco Ginger Paste.		Emil Moscola.
16198	Ginger Ale.		Reiner Bottling Works.
16196	Ginger Ale.		Yale Brewing Co.
16986	Ginger Ale.	*Willimantic:*	Willimantic Bottling Co.

Eight miscellaneous beverages, sodas, cordials, etc., were submitted for determinations of alcohol. All were found to contain alcohol in excess of 0.5 per cent., but as only one sample was submitted in the original unopened bottle the alcohol content as sold by the dealer cannot be stated. The one unopened sample was Cider soda, **16185,** which contained 1.19 per cent. of alcohol by volume. It was sold by the Bristol Bottling Works, Bristol.

Six cereal beverages were submitted, all in original unopened bottles. Palpha **17206,** Brooklyn Bottling Works, Waterbury, and Fingo **15383,** Worcester Brewing Corp., Worcester, Mass., contained 0.61 and 0.84 per cent. alcohol by volume respectively.

Beverages and Fruit Syrups Examined for Saponins.

The presence of foam producers in various soft drinks and in malt liquors has been reported or suggested in the literature. Preparations from soap bark and commercial saponin are used for this purpose but they are objectionable on account of the toxic principles they contain. Glycerrizin, the active principle of licorice, also serves to produce the desired foam.

Tests for saponins are summarized in Leach[1] and we have found them to work satisfactorily upon known saponin solutions. An old commercial preparation labeled "Soda Foam," which we had among our laboratory specimens and a water extract of soap bark responded positively to the tests there described. If glycerrizin is present or suspected the haemolysis test should be used. While it is generally best to extract the saponins and purify them before applying qualitative tests, suspicious samples may be sorted out by inducing foam directly in the solution by passing a current of air through it, collecting the froth and applying tests directly on the liquid formed when the foam subsides.

Six fruit syrups and three cereal beverages were examined for foam producers but negative results were obtained in all cases.

CEREAL PRODUCTS.

Breakfast Foods.

Two fruited cereal preparations have been analyzed. Fruited Wheat, **13973** and Fruited Oats, **13974,** a combination of figs, dates and raisins with wheat and oats respectively. Manufactured for the Fruited Cereal Co., Quincy, Ill.

[1]Food Inspection and Analysis, p. 1016.

Analyses of these products are as follows:

Station No.	13973	13974
	%	%
Moisture	9.89	9.74
Ash	3.60	3.34
Protein	15.63	13.13
Fiber	2.42	1.30
Nitrogen-free extract	66.21	68.10
Fat	2.25	4.[illegible]9

HEALTH FOODS.

Three products of this class have been examined.

Ry-Krisp, **14200**, made by the Original Ry-Krisp Co., Minneapolis, Minn. This preparation is stated in the advertising literature to be made from whole rye "without soda, baking powder, yeast, or any ferment, without sweetening, shortning, or flavoring except a little salt." It is also stated to contain "nine out of the eleven mineral elements (vitamines) necessary for the proper nourishment of the human body". So far as we know it has not been demonstrated that vitamines are mineral elements. A proximate analysis of the preparation is given which is substantially correct. It is not recommended as a diabetic food but its laxative properties are emphasized.

The product was submitted for examination with reference to its usefulness in a diabetic dietary. The analysis shows a normal amount of carbohydrate nearly one-half of which is starch. Its utility in a diabetic diet will depend entirely upon the tolerance of the patient.

Swedish Health Bread, **13628**, made by O. G. Petterson, Cambridge, Mass. Submitted for analysis by a diabetic patient.

Basy Bread, **14405**, made by Doctor's Essential Food Co., Orange, N. J. This is used as an anti obesity remedy. It is stated not to be a medicine or drug but a wholesome and delicious food scientifically prepared. Three slices per day are said to accomplish weight reduction.

The proximate analysis of this preparation is given below. It furnishes no clue of course to the alleged efficacy of the bread as a weight reducer. Having been advised that symptoms resembling those which follow the administration of thyroid had been observed after eating this bread, tests were made for iodine but none was detected. The method of Seidell[1] was employed and amounts up to 20 grams of bread were used. A commercial sample of desiccated thyroid gland[2] was tested by the same procedure and 0.2 per cent. of iodine found. When 10 milligrams of this thyroid preparation were added to 0.99 gm. of bread a positive test for iodine was obtained.

[1]Jour. Biol. Chem., **3**, 391 (1917).

[2]Parke, Davis & Co.

We have since seen a discussion[1] of this product from which we quote.

"According to the manufacturers Basy Bread is made from coarse ground, hard whole wheat, preserved and sweetened with ground figs and containing vinegar, salt and water".

After giving analyses showing the composition of this bread as compared with average graham bread the discussion continues.

"The purchaser of Basy Bread finds that, in addition to eating the preparation for which he is paying $1.00 a loaf, it is also necessary to follow the 'Basy Bread' Diet. This diet is typical of those recommended in the reduction of fat".

By a simple experiment the user of this bread can test its efficacy for himself by adhering rigidly to the prescribed diet omitting the Basy Bread entirely and comparing the results with those obtained when it is included. We suspect that the diet has more to do with weight reduction than has the bread.

The analyses of these three preparations are as follows:

Station No.	**14200**	**13628**	**14405**
	%	%	%
Moisture	5.80	8.55	36.91
Ash	2.78	2.71	2.40
Protein	14.00	10.44	9.59
Fiber	1.34	1.82	1.85
Nitrogen-free extract:			
Starch	34.79	47.73	48.12
Other nitrogen-free extract	39.63	27.68	
Fat	1.66	1.07	1.13

Flour.

Four samples of flour were submitted by the Dairy and Food Commissioner and four samples were sent by individuals. Of the latter, Nos. **15167** and **15173** were represented to be largely gluten. Analyses showed them to contain 2.08 per cent. of nitrogen each which is about the nitrogen content of ordinary flour and much too low for gluten flour of standard quality which should contain not less than 7.1 per cent. of nitrogen on a water free basis or about 6.25 per cent. with the amount of moisture generally present in the market product.

The other samples require no comment.

CIDER.

Six samples were examined. Two, Nos. **18405** and **18424**, were sent by the Dairy and Food Commissioner and four, Nos. **15284, 14172, 14338** and **14339** were submitted by individuals. They were examined chiefly for alcoholic content, but a more complete analysis of **18405** was made as follows:

[1]Jour. Am. Med. Assoc., **70** 6, 407 (1918).

Alcohol by volume	2.87%
Solids	5.92
Ash	0.27
Sugar, as invert	4.01
Acidity, as acetic	0.48
Alkalinity of ash cc. N/10 alkali per 100 gms.	32.1

COCOA.

Four samples have been examined.

Liberty Milk Cocoa, **18408**, labeled pure milk cocoa, submitted by the Dairy and Food Commissioner was analyzed as follows:

Moisture		2.00%
Ash		2.06
Alkalinity of ash, cc. N/10 acid/1 gm.	0.75	
Nitrogen:		
Total	1.60	
From casein	0.42	
Protein:		
Casein		2.68
Other protein		7.38
Fiber		1.48
Nitrogen-free extract:		
Sucrose		65.09
Lactose		4.83
Other N-free extract		4.48
Fat		10.00

The sample appears to be as labeled.

Three samples of unsweetened cocoa submitted by a consumer were of normal composition and quality.

COFFEE, MODIFIED COFFEE, ETC.

Fourteen samples of ground coffee, two of soluble coffee, one of Kaffee Hag and one coffee substitute have been examined.

Two of these were submitted by the Dairy and Food Commissioner. **16393** contained chicory and much starchy matter and was labeled coffee, cereal and chicory. **16721** appeared to be genuine and was passed.

Sample **15158** sent by a purchaser to be tested for adulterants also appeared to be genuine.

Kaffee Hag, **13980**, is coffee from which the caffein has been largely removed. It was found to contain 0.12 per cent. caffein by weight and 0.10 per cent. of caffein calculated from nitrogen in the caffein residue. Previous results[1] were 0.04 and 0.03 per cent. respectively.

Minute Brew, **13981**, a substitute for coffee made from cereal grains contained 11.25 per cent. of protein (N x 6.25), 1.55 per cent. of material insoluble in hot water and was free from caffein.

Partial analyses of eleven samples of ground coffee and two of soluble coffee are given in Table I.

TABLE I. PARTIAL ANALYSES OF COFFEE.

Sta. No.	Brand.	Manufacturer.	Water. %	Ash. %	Fat. %	Caffein, by Wt. %	Caffein, from N. %	Evidence of Chicory, Cereals, etc.
	Soluble Coffee.							
13938	Barrington Hall	Baker Importing Co., New York and Minneapolis.	4.12	15.51	1.32	5.66	5.50	......
13202	Faust Instant	C. F. Blanke Tea and Coffee, Co., St. Louis.	5.37	14.88	1.11	4.47	4.36	......
	Ground Coffee.							
13203	Autocrat	Brownell Field Co., Providence, R. I.	5.56	4.05	15.48	.....	.....	none
13182	Benefit	Direct Importing Co., Boston.	7.28	4.03	15.24	.....	.....	none
13966	Boardman's Gold Star	Wm. Boardman Sons Co., Hartford.	6.05	4.23	15.09	.....	.....	none
13940	Boardman's Putnam	Wm. Boardman Sons Co., Hartford.	3.97	4.09	16.21	.....	.....	none
13953	Garden of Allah	Clark & MacKasick Co., Boston.	6.43	4.12	16.40	.....	.....	none
13964	Golden Star	F. C. Bushnell Co., New Haven.	4.57	4.05	14.83	.....	.....	none
13174	Hermitage	Stoddard, Gilbert & Co., Inc., New Haven.	7.09	4.02	15.34	.....	.....	none
13952	Hodbro	Hodes Bros., New Haven.	4.79	4.11	15.44	.....	.....	none
13965	Sunbeam	Austin, Nichols & Co., New York and Chicago.	2.14	4.24	14.63	.....	.....	none
13941	Union Club	Chas. G. Lincoln & Co., Hartford.	4.69	4.08	15.66	.....	.....	none
13939	White House	Dwinell-Wright Co., Boston and Chicago.	4.49	4.16	15.86	.....	.....	none

The soluble coffees are evaporated and pulverized water ex tracts of coffee. Another preparation of this type, viz., G. Wash ington Prepared Coffee has been analyzed previously[1] in thi laboratory.

DESICCATED FOODS.

A number of evaporated or dried food products made by th Keystone Instant Food Co., Inc., Danbury, Conn., have bee analyzed. The products include Clam Broth, **15460**; Vegetabl Soup, **15461**; Chicken Gumbo, **15462**; Rice Pudding, **15463** Roast Beef Hash, **15464**, and Corned Beef Hash, **15465.**

Another product of this type is Cheshire Rabbit, **15184**, **1518** made by Cheshire Kitchens, Inc., 15 Park Row, N. Y. This is a evaporated prepared Welsh rabbit ready to serve after addin milk or water and heating.

Our analyses of these products are as follows:

TABLE II.—ANALYSES OF DESICCATED FOODS.

No.	**15460** %	**15461** %	**15462** %	**15463** %	**15464** %	**15465** %	**15184** %	
Moisture	8.38	10.58	10.06	6.67	10.81	8.29	9.18	1
Ash	34.51	13.67	8.22	3.09	7.15	8.39	7.43	
Protein	36.38	14.06	12.50	12.06	32.25	31.38	30.69*	2
Fiber	.....	3.38	1.26	0.36	0.97	0.80	} 13.40	1
Nitrogen-free Extract	19.00	56.56	66.23	77.74	42.31	41.81		
Fat	1.73	1.75	1.73	0.08	6.51	9.33	39.30	3
Salt	29.20	.....	.....	.....	.....	.....	2.84	
Acidity, as lactic acid	.....	.....	.....	.....	.....	.....	1.80	
Color	.....	.....	.....	.....	.....	.....	natural	Or

*Nitrogen x 6.38.

DIABETIC FOODS.

A number of diabetic preparations have been examined sinc our Bulletin 220 on this subject was published. Among them i an interesting product called Cellu Flour.

Cellu Flour, **14555**, is prepared by the Dietetic Cellulose Co. Chicago. It is a carbohydrate substitute made from purified an bleached wood pulp, straw pulp or cotton fiber; it is white, taste less and non-nutritive, containing no starch, sugar, fat or protein and is used for filling out reduced diets such as indicated in th Allen Treatment of diabetes. While it furnishes no nourishmen it is said to satisfy hunger and reduces the tendency to over-eat It might be called a psychological food.

The analysis of this flour is as follows:

[1]Conn. Exp. Sta. Report 1916, pp. 186–7.

Moisture	5.52%
Ash	0.30
Protein	none
Fiber	57.25
Nitrogen-free extract:	
Starch	none
Reducing-sugars:	
before hydrolysis	none
after hydrolysis	none
Other nitrogen-free extract (modified cellusoses)	36.93
Ether extract	trace

By the conventional method of proximate analysis this material showed 57.25 per cent. of crude fiber and a nitrogen-free extract of 36.93 per cent. It was found, however, that neither the acid nor alkali digestates as obtained in the determination of crude fiber produced copper reducing substances and that therefor presumably, little of the material thus removed is available in digestion but consists rather of soluble cellulose complexes or modifications. This emphasizes the inaccuracy that, in some cases, may attach to the interpretation of nitrogen-free extract as available carbohydrate in calculating calorie yields.

Our attention was called by William G. Beale, of Chicago, and Bar Harbor, Me., to certain bakery products prepared from Cellu flour by the Woman's Baking Co., of Boston. This Company has submitted, at our request, a number of their products which are of particular interest. Samples were also submitted by Mr. Beale.

The products examined are as follows:

Cellu Muffins, **15256**; Bran Muffins, **15257**; Cellu Caraway Cookies, **15258**; Cellu Lemon Cookies, **15259**; Cellu Kisses, **15260**; Cellu Nuts, **15314**; Cocoa Nib Cookies, **15315**; Spice Bran Cookies, **15316**; Cellu Vanilla Cookies, **15317**; Cellu Soup Wafers, **15318**; Cellu Biscuit **15319**; Caraway Bran Cookies, **15320**.

Table III.—Analyses of Cellu Flour Products, etc.

. No.	Moisture.	Ash.	Nitrogen.	Protein N x 6.25.	Fiber.	Nitrogen-free Extract.			Fat.	Calc pe 10 gn[illegible]
						Starch.	Sugar as dextrose.	Other N-free extract.		
	%	%	%	%	%	%	%	%	%	
256	29.08	5.37	0.59	3.66	18.23	1.61	2.10	27.02	12.93	2[illegible]
257	41.51	6.50	1.00	6.26	6.72	1.54	4.83	27.03	5.61	2[illegible]
258	14.16	5.48	0.89	5.58	16.53	1.51	2.33	31.95	22.46	3[illegible]
259	12.94	5.22	0.69	4.32	17.43	trace	4.62	34.10	21.37	3[illegible]
260	17.85	4.09	3.68	23.00	27.12	1.29	1.20	25.22	0.23	2[illegible]
314	15.91	5.71	0.86	5.38	16.80	1.07	2.57	23.82	28.74	3[illegible]
315	14.87	6.30	1.33	8.32	6.05	6.19	5.05	29.17	24.04	4[illegible]
316	16.31	6.43	1.12	6.99	6.90	4.44	7.77	32.48	18.68	3[illegible]
317	17.16	5.69	0.71	4.45	16.98	1.58	2.22	32.61	19.31	3[illegible]
318	14.22	6.66	0.64	4.01	14.97	1.69	2.43	31.39	24.63	3[illegible]
319	32.81	6.33	0.53	3.34	14.26	1.60	1.41	25.65	14.60	2[illegible]
320	12.24	6.90	1.30	8.13	2.62	3.15	3.34	38.61	25.01	4[illegible]

These Cellu products are conspicuous for their low nitrogen (except **15260**), low available carbohydrate (starch and soluble reducing sugars), high fiber and high nitrogen-free extract other than starch and sugar. The low or doubtful availability of the last named group should be borne in mind when interpreting the calorie yield which has been calculated in the conventional way including all of the nitrogen-free extract. The bran and part-bran products have distinctly less fiber.

Seven samples of liquors were examined with reference to their fitness for use in a diabetic dietary. Four of the samples were practically free from sugars, one contained a small amount, 3.09 per cent., and two showed larger amounts viz. 14.2 per cent. and 33.52 per cent. The last named amount is too high to be used with safety, and a stimulant with 14 per cent. of sugar should be used with caution.

EGGS AND EGG PRODUCTS.

Twenty-six samples of eggs were examined with reference to the composition of the shells. This work was done in collaboration with Prof. Dunn, of the Storrs Station. The figures given are on the basis of the air-dry shells with the inner membranous lining of the shell removed.

TABLE IV.—ANALYSES OF EGG SHELLS.

Sta. No.	Wt. of shell. grams.	Moisture.	Lime (CaO).	Magnesia (MgO).	Loss on ignition.
		%	%	%	%
15223	5.7745	0.55	52.20	1.54	45.42
15224	5.7643	0.39	52.24	....	46.07
15225	5.4725	0.29	52.16	2.48	45.78
15226	5.0275	0.35	52.08	1.04	46.25
15227	6.2050	0.29	52.01	1.20	46.15
15228	5.1178	0.40	51.56	1.35	46.39
15229	4.4340	0.29	51.82	....	46.15
15230	5.8283	0.22	51.91	....	45.70
15231	4.8030	0.21	51.99	1.43	45.92
15232	5.0580	0.23	53.28	....	45.54
15233	5.3550	0.34	53.28	....	45.41
15234	5.5155	0.50	51.85	1.61	45.69
15235	5.0840	0.50	52.69	....	45.77
15236	5.4008	0.63	52.18	....	45.67
15237	5.0183	0.64	52.36	....	45.70
15264	4.8412	....	49.40	....	.....
15265	4.8932	....	52.12	....	.....
15266	5.4114	....	51.04	....	.....
15267	5.2107	....	51.16	....	.....
15268	5.5765	....	51.12	....	.....
15269	5.6312	....	49.16	....	.....
15270	5.3247	....	51.56	....	.....
15271	4.9495	....	50.68	....	.....
15272	5.7060	....	50.88	....	.....
15273	4.9926	....	49.52	....	.....
15274	5.4776	....	50.32	....	.....

Egg Powder.

One sample, No. **14680**, was submitted for examination. It was labeled Aigo Baking and Cooking Compound, The Egg-O Co., Baltimore, Md., and stated to consist of sprayed egg yolk, albumen, salt, powdered skimmed milk, starch, gelatin, bicarbonate of soda and to be free from coloring matter.

The presence of egg was indicated by a considerable amount of lecithin phosphoric acid and no artificial color was found.

The anaylsis is as follows:

No.	14680
	%
Moisture	6.83
Ash	9.47
Protein (N x 6.25)	20.48
Starch	26.40
Fat	13.85
Lecithin P_2O_5	0.46
Color	natural.

Egg Noodles.

Eight samples of noodles were examined and the partial analyses are given in the following tabulation.

Table V.—Partial Analyses of Egg Noodles.

a. o.	Brand.	Manufacturer or Dealer.	Ash.	Protein.	Lecithin P_2O_5.	Co
			%	%	%	
204	Mohican.	Mohican Co., Bridgeport	0.88	16.25	0.044	nat
205	Mueller's.	C. F. Mueller Co., Jersey City	1.15	13.88	0.037	nat
208	Warner's.	Warner Macaroni Co., Inc., Syracuse, N. Y.	0.68	14.88	0.028	nat
209	Freihofer's.	Freihofer Baking Co., Philadelphia, Pa.	0.51	12.94	0.034	nat
935	Climax.	The Pfaffmann Egg Noodle Co., Cleveland, Ohio	1.66	13.44	0.045	nat
937	Egg Soup Pastels.	Freihofer Baking Co., Philadelphia, Pa.	0.78	13.19	0.029	nat
962	Quaker.	Quaker Oats Co., Chicago	0.75	15.00	0.066	nat
976	Brown Hen.	American Macaroni Co., Camden, N. J.	1.04	16.56	0.043	nat

The lecithin phosphoric acid content is taken as an index to the amount of egg material present. Accepting Juckenack's standard[1], 0.0225 per cent. of lecithin phosphoric acid may be found in noodles prepared without eggs and this amount is more than doubled by the addition of egg or egg yolk in the proportion of one to a pound of flour. Figures less than 0.035 or 0.040 per cent. do not indicate appreciable amounts of eggs.

[1]Conn. Exp. Sta. Report 1904, p. 138: Leach, Food Inspection and

Dehydrated Eggs.

Two samples of dehydrated fresh eggs were examined. These were Atlas Brand, **13173**, Atlas Specialty Co., New York and Community Brand, **13169**, The Sweet Nut Butter Co., Boston.

Analyses are as follows:

No.	**13173**	**13169**
	%	%
Moisture	6.25	6.62
Ash	3.42	3.50
Protein	40.44	43.00
Fat	45.12	42.29
Lecithin P_2O_5	1.37	1.33

These analyses agree with those of similar products previously examined[1] and show the substance of whole egg material.

FATS AND OILS.

Olive Oil.

Five samples of olive oil have been examined and all were passed as genuine. Two of these were sent by the Dairy and Food Commissioner and three were submitted by individuals.

Cooking Fats.

Two samples of Snowdrift Pure Vegetable Shortening **13972** and **18404** and one of Peerless Paste **16158** were examined. Snowdrift is a vegetable product consisting of, or containing cottonseed oil. Peerless Paste contains cottonseed oil but not butter fat although other fat of animal origin may be present. It is interesting to note that this sample responds to tests for carrotin although the material is not sensibly colored.

Butter.

Twenty-three samples of butter have been examined of which twenty-two were submitted by the Dairy and Food Commissioner. Eighteen were passed and five contained excess of water and were deficient in fat. Butter and renovated butter must not contain less than 82.5 per cent. of milk fat and renovated butter must not contain more than 16 per cent. of water.[2] There is no standard for moisture in the definition of butter but obviously it cannot contain much over 16 per cent.

The five samples which did not meet the above requirements are tabulated as follows:

[1]Conn. Exp. Sta. Bull. 210, p. 212, (1918).
[2]State Regulation 48.

BUTTER BELOW STANDARD.

No.	Sold for	Dealer (New Haven).	Water.	Curd, Salt, etc.	Fat.	Refraction,
			%	%	%	25°C.
5	"Undergrade" butter	J. L. Gold	28.44	1.28	70.28	53.1
8	Sweet Butter	Morris Gold	22.08	77.92		50.6
6	Renovated Butter	Morris Gold	29.77	0.93	69.30	52.3
0	Sweet Butter	Liebmann & Gold	27.03	72.97		51.2
2	Sweet Butter	Liebmann & Gold	28.71	1.18	70.11	53.0

The adulteration in the above cases consists of excess water and consequent deficiency of milk fat. Sample **18105** was sold for about one half the market price of butter and was marked undergrade so that its substance and quality were not misrepresented. Samples **16898, 18476, 16900** and **18302** were renovated.

OLEOMARGARINE.

Five samples, all submitted by the Dairy and Food Commissioner, were examined for coloring matter, but no evidence of added dyestuffs was obtained. In no case was the product sold for butter.

NUT MARGARINE.

Two new brands of this product have been examined, **13963,** Delicia and **13971,** Palmine, both sold by Van Dyke's Tea Store, New Haven. The analyses of these brands and of eight brands previously reported[1] are given in Table VI.

GELATIN, ETC.

Seven unofficial samples of gelatin were submitted by the Dairy and Food Department for examination. Three of these were distinctly inferior products indicated by bad odor, high fat or high keratin, or both, and in one case by excessive arsenic content.

The data on these products are as follows:

Designation of sample	A 15	A 16	A 21
Total nitrogen	15.69%	15.23%	14.92%
Ash	1.90	2.95	2.84
Fat	0.17	0.30	0.45
Keratin	0.09	0.18	0.11
Arsenic	1:500,000	1:50,000	trace
Copper	none	none	....
Odor	disagreeable	slight	disagreeable
Water solution, cold	cloudy	very cloudy	cloudy
hot	clear	cloudy	....

The ash should not exceed 2 per cent., the fat and keratin should not be much in excess of 0.08 per cent. each, arsenic does not

[1]Conn. Exp. Sta., Bull. 210 p. 203, (1918).

TABLE VI.—ANALYSES OF

Number.	Brand, Manufacturer or Dealer.	Moisture.
		%
186	A 1. Downey Farrell Co., Chicago	10.84
169	Cocoanut. Nucoa Butter Co., Soho Park, N. J.	6.53
170	Providence Churning Co., Providence, R. I.	11.28
883	Nut-ola. Armour Co.	9.44
898	Gem. Swift & Co.	12.64
911	Benefit. Sweet Nut Butter Co., Boston, Mass.	12.35
937	Kingnut. Kellogg Products, Inc., Buffalo	10.12
938	Nut Marigold. Marigold Margarine Fact. 5th Dist., N.J.	14.71
963	Delicia. Van Dyke, New Haven	10.67
971	Palmine. Van Dyke, New Haven	13.08

dinarily exceed 1:700,000, a good product should be without lor, and the water solution should be clear.[1]

A product used as a substitute for gelatin in ice cream manucture was also submitted, No. **16396.** This was found to consist iefly of starch and Indian gum. Tests for gelatin and tragacanth ;re negative. The sample contained 2.48 per cent. of ash, 1.60 ·r cent. of nitrogen and 37.17 per cent. of starch.

ICE CREAM.

Chapter 260 of the Public Acts of 1919 regulates the manufacture .d sale of ice cream in this State. It provides that the milk fat ntent of ice cream (plain) shall be not less than 8 per cent. and at of fruit and nut ice cream not less than 6 per cent. The esence of boric acid, salicylic acid, formaldehyde, saccharin, lts of copper, iron oxide, ochres and injurious colors or flavors in ;y ice cream is prohibited. Harmless permitted colors and .rmless imitation flavors are allowed if their presence is declared. ıe use of harmless vegetable gums and gelatin is permitted; and ; cream containing less fat than that required by the standards ay be manufactured and sold provided the true fat content is ade know to the purchaser by suitable signs or labels.

The Dairy and Food Commissioner made a preliminary inection last year and several hundred samples were taken. These ;re used as a basis for hearings to advise manufacturers and others

[1]Conn. Exp. Sta. Bull 219 p. 221, (1919).

NUT MARGARINES.

Protein (Nx6.25).	Ash.	Fat.	Free Fatty Acids as Oleic.	Refractometer Reading at 40°C.	Reichert-Meissel No.	Halphen Test.	Nitric Acid Test.
%	%	%	%				
1.25	4.51	83.40	0.45	40.0	7.00	deep pink	brown
0.69	1.58	91.20	0.39	37.2	7.50	yellow	brown
0.75	1.14	86.83	0.47	39.0	6.15	yellow	yellow
2.71	6.06	81.75	0.25	39.0	6.37	yellow	......
1.36	2.91	83.09	0.95	40.0	6.69	pink	......
1.29	2.08	84.27	1.11	37.0	6.22	yellow	......
1.87	3.00	85.01	0.19	38.5	6.50	yellow	......
1.19	1.51	82.58	1.03	38.0	6.62	yellow	......
1.66	1.93	85.74	....	35.5	6.40	yellow	yellow
0.83	4.33	81.76	....	36.5	7.90	yellow	yellow

of the provisions of the law. Subsequently 82 official samples were taken of which only three were found to be below standard.

During the past year 47 cities and towns were visited and 400 samples collected. The distribution of the samples and results of analyses are given in the following summary.

Kind of Ice Cream.	No. of Samples collected.	No. of Samples below standard.	Per cent. below standard.
Plain ice cream	331	45	13.6
Fruit ice cream	66	2	3.0
Nut ice cream	3	0	0.0
Total	400	47	11.8

A comparison with the results obtained last year based upon the percentages of milk fat in the sample is as follows:

Range of Fat.	1919 Samples.	1919 Per cent.	1920 Samples.	1920 Per cent.
8 to 8.9	15	18.3	79	19.7
9 to 9.9	10	12.2	55	13.8
10 to 11.9	26	31.7	83	20.8
12 to 13.9	15	18.3	67	16.7
14 to 19.9	13	15.8	56	14.0
20 and above	0	....	2	0.5
Below 8.0	3	3.7	58*	14.5
Total	82	100.0	400	100.0

*Includes 11 fruit creams of legal standard.

The results of the inspection during the past year are given in detail in Table VII. Figures below 8 per cent. in the case of plain ice cream and below 6 per cent. in the case of fruit and nut creams appear in full face type.

TABLE VII.—ANALYSES OF ICE CREAM.

D. C. No.	Dealer.	Manufacturer.	Flavor.
	*BRIDGEPORT.		
17346	J. E. Broderick	Stratford Candy Kitchen	Chocolate
17349	D. J. Broderick	Harris Hart	Chocolate
17340	Frank Cuneo	Own make	Chocolate
17345	Eagle Confectionery Co	Own make	Chocolate
18228	Sigmund Gerstl	Own make	Chocolate
18446	E. L. Graves	Own make	Chocolate
17347	Ideal Ice Cream Co	Stratford Ice Cream Co	Chocolate
17334	Lane Confectionery Co	Own make	Chocolate
17342	Andrew Musante	Own make	Chocolate
18440	New England Ice Cream Co	Own make	Chocolate
18443	George Nicholas	Own make	Chocolate
17337	Regas & Pappas	Own make	Chocolate
18225	Royal Candy Kitchen	Own make	Chocolate
18449	Strand Confectionery Co	Own make	Chocolate
18223	George Casrientes	Own make	Strawberry
18226	Crystal Palace Conf. Co	Own make	Strawberry
18447	E. L. Graves	Own make	Strawberry
17335	Lane Confectionery Co	Own make	Strawberry
17343	Andrew Musante	Own make	Strawberry
18441	New England Ice Cream Co	Own make	Strawberry
18444	George Nicholas	Own make	Strawberry
17338	Regas & Pappas	Own make	Strawberry
18222	Crystal Palace Conf. Co	Own make	Vanilla
17339	Frank Cuneo	Own make	Vanilla
17334	Eagle Confectionery Co	Own make	Vanilla
18227	Sigmund Gerstl	Own make	Vanilla
18445	E. L. Graves	Own make	Vanilla
17331	Horsoof Kachbourian	Huber Ice Cream Co	Vanilla
17333	Lane Confectionery Co	Own make	Vanilla
17341	Andrew Musante	Own make	Vanilla
18439	New England Ice Cream Co	Own make	Vanilla
18442	George Nicholas	Own make	Vanilla
18229	Frank Ostrofsky	Own make	Vanilla
17332	The Park Spa	Huber Ice Cream Co	Vanilla
17336	Regas & Pappas	Own make	Vanilla
18224	Royal Candy Kitchen	Own make	Vanilla
17325	Louis Slavin	New England Ice Cream Co	Vanilla
18448	Strand Confectionery Co	Own make	Vanilla
	Average		
	BRISTOL.		
17929	Bristol Candy Kitchen	Own make	Chocolate
17919	J. A. Kennedy	New Haven Dairy	Chocolate
17925	Palace of Sweets	Own make	Chocolate
17923	St. Clair Confectionery Co	Own make	Chocolate
17928	Bristol Candy Kitchen	Own make	Strawberry
17926	Bristol Candy Kitchen	Own make	Vanilla

TABLE VII.—ANALYSES OF ICE CREAM.—*Continued.*

'. C. No.	Dealer.	Manufacturer.	Flavor.	F
	BRISTOL—(*concluded*).			
920	J. A. Kennedy	New Haven Dairy Co	Vanilla	
924	Palace of Sweets	Own make	Vanilla	1
922	St. Clair Confectionery Co	Own make	Vanilla	1
	Average			1
	COS COB.			
205	M. Taylor	Horton Ice Cream Co	Strawberry	
204	M. Taylor	Horton Ice Cream Co	Vanilla	
	Average			
	DANBURY.			
319	Danbury Candy Co	Own make	Chocolate	
257	H. E. Northrop	Own make	Chocolate	1
320	D. F. Stevens	Own make	Chocolate	
252	Athan & Nicholson	Own make	Strawberry	
254	Charles Ryder Ice Cream Co	Own make	Strawberry	1
255	Charles Ryder Ice Cream Co	Own make	Strawberry	1
318	Danbury Candy Co	Own make	Vanilla	1
251	Athan & Nicholson	Own make	Vanilla	
253	Charles Ryder Ice Cream Co	Own make	Vanilla	1
321	D. F. Stevens	Own make	Vanilla	
	Average			
	DANIELSON.			
084	Mary Salotti	Own make	Chocolate	
763	Ephrem Auger	J. H. Bouthillier	Coffee	
848	Cola Bros	Own make	Coffee	
762	Ephrem Auger	J. H. Bouthillier	Strawberry	
083	Mary Salotti	Own make	Strawberry	
761	Ephrem Auger	J. H. Bouthillier	Vanilla	1
206	George Berris	New Haven Dairy	Vanilla	
847	Cola Bros	Own make	Vanilla	
100	Mary Salotti	Own make	Vanilla	
764	A. P. Woodward	Own make	Vanilla	
	Average			
	EAST PORT CHESTER			
273	J. Tuchim	Neilsons	Chocolate	
274	J. Tuchim	Neilsons	Strawberry	
300	J. Tuchim	Neilsons	Vanilla	
	Average			
	FAIRFIELD.			
260	Henderson Bros	Huber Ice Cream Co	Chocolate	
350	Henderson Bros	Huber Ice Cream Co	Vanilla	1
	Average			1

TABLE VII.—ANALYSES OF ICE CREAM.—*Continued.*

D. C. No.	Dealer.	Manufacturer.	Flavor.
	FARMINGTON.		
17501	Frederick Swanston............	Hackney.........	Chocolate....
17502	Frederick Swanston............	Hackney.........	Vanilla.......
	Average................	....	....
	FORESTVILLE.		
17917	Purity Ice Cream Co..........	Own make........	Chocolate....
17913	White Rock Ice Cream Co......	Own make........	Chocolate....
17915	White Rock Ice Cream Co......	Own make........	Maple........
17918	Purity Ice Cream Co..........	Own make........	Strawberry...
17914	White Rock Ice Cream Co......	Own make........	Strawberry...
17911	James Holden................	White Rock Ice Cream Co......	Vanilla.......
17916	Purity Ice Cream Co..........	Own make........	Vanilla.......
17912	White Rock Ice Cream Co......	Own make........	Vanilla.......
	Average................	....	....
	GREENWICH.		
18291	Greenwich Drug Store.........	Horton Ice Cream Co............	Chocolate....
18289	Finch's Pharmacy............	Horton Ice Cream Co............	Chocolate....
18282	J. H. Hall....................	Own make........	Chocolate....
18280	Kataris & Joseph.............	Own make........	Chocolate....
18287	A. B. Libano..................	Own make........	Chocolate....
18202	Pickwick Shop................	Own make........	Chocolate....
18203	Pickwick Shop................	Own make........	Coffee........
18283	J. H. Hall....................	Own make........	Strawberry...
18278	L. Kataris....................	Own make........	Strawberry...
18286	W. B. Libano.................	Own make........	Strawberry...
18276	Frank Zamfino................	Own make........	Strawberry...
16168	Boswell Drug Co..............	Horton Ice Cream Co............	Vanilla.......
18292	Boswell Drug Co..............	Horton Ice Cream Co............	Vanilla.......
18288	W. E. Fitch's Pharmacy........	Horton Ice Cream Co............	Vanilla.......
18290	Greenwich Drug Store..........	Horton Ice Cream Co............	Vanilla.......
18281	J. H. Hall....................	Own make........	Vanilla.......
18277	L. Kataris....................	Own make........	Vanilla.......
18279	Kataris & Joseph.............	Own make........	Vanilla.......
18289	A. B. Libano..................	Own make	Vanilla ......
18201	Pickwick Shop................	Own make	Vanilla.......
18275	Frank Zamfino................	Own make........	Vanilla.......
	Average................	....	....
	GROTON.		
18689	Scuris Bros....................	Own make........	Chocolate....
18688	Scuris Bros....................	Own make........	Vanilla.......
	Average................	....	....

TABLE VII.—ANALYSES OF ICE CREAM.—*Continued.*

). C. No.	Dealer.	Manufacturer.	Flavor.	]
	HARTFORD.			
092	Thomas Appell	Own make	Chocolate	
904	Atlas Confectionery Co	Own make	Chocolate	
852	Besse	Own make	Chocolate	1
096	Crown Confectionery Co	Own make	Chocolate	1
902	Eagle Confectionery Co	Own make	Chocolate	1
854	Goodwin Drug Co	Own make	Chocolate	1
905	Goodwin Drug Co	Own make	Chocolate	
909	A. P. Leonard	Own make	Chocolate	1
097	Liberty Confectionery Co	Own make	Chocolate	1
859	Palace of Sweets	Own make	Chocolate	1
089	Royal Candy Kitchen	Own make	Chocolate	
908	J. P. Treautafelacos	Own make	Chocolate	1
093	Thomas Appell	Own make	Strawberry	
098	Crown Confectionery Co	Own make	Strawberry	1
855	Goodwin Drug Co	Own make	Strawberry	1
099	Liberty Confectionery Co	Own make	Strawberry	1
090	Royal Candy Co	Own make	Strawberry	1
091	Thomas Appell	Own make	Vanilla	1
903	Atlas Confectionery Co	Own make	Vanilla	1
851	Besse	Own make	Vanilla	1
094	Crown Confectionery Co	Own make	Vanilla	1
901	Eagle Confectionery Co	Own make	Vanilla	1
853	Goodwin Drug Co	Own make	Vanilla	1
906	Goodwin Drug Co	Own make	Vanilla	1
910	A. P. Leonard	Own make	Vanilla	1
095	Liberty Confectionery Co	Own make	Vanilla	
857	Newton Robinson & Co	Own make	Vanilla	
858	Palace of Sweets	Own make	Vanilla	1
088	Royal Candy Co	Own make	Vanilla	1
907	J. P. Treautafelacos	Own make	Vanilla	1
856	Wise, Smith & Co	Hartford Ice Cream Co	French Vanilla	1
	Average			1
	JEWETT CITY.			
773	Fred Maynard	Own make	Chocolate	
284	Alleandro Picraccini	Own make	Chocolate	
775	Dennis J. Sullivan	Own make	Chocolate	
774	Dennis J. Sullivan	Own make	Lemon	
230	Alleandro Picraccini	Own make	Vanilla	
772	Fred Maynard	Own make	Vanilla	1
	Average			
	KILLINGLY.			
399	Fred Espinosa	Own make	Coffee	
000	Fred Espinosa	Own make	Vanilla	
	Average			
	MANCHESTER.			
343	Manchester Dairy Ice Cream Co.	Own make	Chocolate	
345	Manchester Dairy Ice Cream Co.	Own make	Coffee	1
344	Manchester Dairy Ice Cream Co.	Own make	Strawberry	1
342	Manchester Dairy Ice Cream Co.	Own make	Vanilla	1

TABLE VII.—ANALYSES OF ICE CREAM.—*Continued.*

D. C. No.	Dealer.	Manufacturer.	Flavor.
	MERIDEN.		
17279	Allis Bros	Own make	Caramel
17281	Albert Eichorn	Own make	Cherry Bisque.
17278	Allis Bros	Own make	Chocolate
17284	Clarence Katt	Own make	Chocolate
17288	New Haven Dairy Plant	Own make	Chocolate
17282	Albert Eichorn	Own make	Maple Nut
17286	J. F. Furman	Own make	Strawberry
17285	Clarence Katt	Own make	Strawberry
17289	New Haven Dairy Plant	Own make	Strawberry
17290	New Haven Dairy Plant	Own make	Tutti Fruitti
17277	Allis Bros	Own make	Vanilla
17280	Albert Eichorn	Own make	Vanilla
17292	Mrs. Sarah Furman	J. F. Furman	Vanilla
17283	Clarence Katt	Own make	Vanilla
17287	New Haven Dairy Plant	Own make	Vanilla
	Average		
	MILFORD.		
17348	Ideal Ice Cream Co	Stratford Ice Cream Co	Vanilla
	MOOSUP.		
17768	Habbib Abbood	Own make	Chocolate
17771	F. W. Daggett	Own make	Coffee
17767	Habbib Abbodd	Own make	Vanilla
17769	Devisso & Co	Connie McGaughery	Vanilla
	Average		
	MYSTIC.		
18691	Peter Hammecher	Own make	Chocolate
18695	E. W. Haskell	Own make	Coffee
18693	John Wheeler	Own make	Coffee
18694	E. W. Haskell	Own make	Vanilla
18690	Peter Hammecher	Own make	Vanilla
18692	John Wheeler	Own make	Vanilla
	Average		
	NEW BRITAIN.		
17880	Louis Gourson	Hartford Ice Cream Co	Chocolate
17308	C. E. McEnroe	Own make	Chocolate
17883	John Contaris	Own make	Chocolate
17305	St. Clair Confectionery Co	Own make	Chocolate
17302	Star Confectionery Co	Own make	Chocolate
17306	St. Clair Confectionery Co	Own make	Strawberry
17303	Star Confectionery Co	Own make	Vanilla
17882	John Contaris	Own make	Vanilla
17881	Edith Kopel	New Haven Dairy	Vanilla
17307	C. E. McEnroe	Own make	Vanilla
17304	St. Clair Confectionery Co	Own make	Vanilla
17301	Star Confectionery Co	Own make	Vanilla
	Average		

TABLE VII.—ANALYSES OF ICE CREAM.—*Continued.*

D. C. No.	Dealer.	Manufacturer.	Flavor.
	NEW HAVEN.		
7315	John Basel	Own make	Chocolate
7255	Davis Drug Co	New Haven Dairy	Chocolate
7258	Huylers	Own make	Chocolate
7257	Liggett Drug Co	Semon Ice Cream Co	Chocolate
3460	New Haven Dairy Co	Own make	Chocolate
7262	Petersons	New Haven Dairy	Chocolate
7310	Theodore Tramis	Own make	Chocolate
7310	Peter Vallani	Own make	Chocolate
7311	Peter Vallani	Own make	Peach
7316	John Basel	Own make	Strawberry
7261	Huylers	Own make	Strawberry
3461	New Haven Dairy	Own make	Strawberry
7314	John Basel	Own make	Vanilla
7354	Davis Drug Co	New Haven Dairy	Vanilla
7259	Huylers	Own make	Vanilla
7256	Liggett Drug Co	Semon Ice Cream Co	Vanilla
3462	New Haven Dairy	Own make	Vanilla
7260	Petersons	New Haven Dairy	Vanilla
7296	Theodore Tramis	Own make	Vanilla
7309	Peter Vallani	Own make	Vanilla
	Average		
	NEW LONDON.		
3687	Dimon Ballassi	Own make	Chocolate
3671	Conti Bros	Own make	Chocolate
3665	George Kozinos	Own make	Chocolate
3673	Johns & Manabas	Own make	Chocolate
3669	Peter Lalaty	Own make	Chocolate
3685	Basil D. Nichols	Own make	Chocolate
3623	Emanual Nichols	Own make	Chocolate
3675	S. F. Peterson	Own make	Chocolate
3677	Socrates Peterson	Own make	Chocolate
3675	E. E. Stratas	Own make	Chocolate
3681	Mohican Hotel	Own make	Coffee
3667	Abraham J. Maloof	Own make	Lemon
3686	Dimon Ballassi	Own make	Vanilla
3670	Conti Bros	Own make	Vanilla
3664	George Kozinos	Own make	Vanilla
3672	Johns & Manabas	Own make	Vanilla
3668	Peter Lalaty	Own make	Vanilla
3666	Abraham J. Maloof	Own make	Vanilla
3680	Mohican Hotel	Own make	Vanilla
3684	Basil D. Nichols	Own make	Vanilla
3682	Emanual Nichols	Own make	Vanilla
3676	Socrates Peterson	Own make	Vanilla
3674	S. F. Peterson	Own make	Vanilla
3678	E. E. Stratas	Own make	Vanilla
	Average		

TABLE VII.—ANALYSES OF ICE CREAM.—*Continued.*

D. C. No.	Dealer.	Manufacturer.	Flavor.
	NORWALK.		
18298	Combis Candy Kitchen	DeKlym	Chocolate.
18265	M. Cowas	Own make	Chocolate.
18271	Cochinos & Notis	Own make	Chocolate.
16170	Solomon Hatten	Horton Ice Cream Co	Chocolate.
18293	C. DeKlym	Own make	Chocolate.
18268	Zapperson & Pappas	Own make	Chocolate.
18272	Cochinos & Notis	Own make	Coffee
18299	Combis Candy Kitchen	Own make	Strawberry
18266	M. Cowas	Own make	Strawberry
16171	Solomon Hatten	Horton Ice Cream Co	Strawberry
18296	C. DeKlym	Own make	Strawberry
18269	Zapperson & Pappas	Own make	Strawberry
18270	Cochinos & Notis	Own make	Vanilla
18297	Combis Candy Kitchen	DeKlym	Vanilla
18264	M. Cowas	Own make	Vanilla
18395	C. DeKlym	Own make	Vanilla
18267	Zapperson & Pappas	Own make	Vanilla
	Average		
	NORWICH.		
18245	Tilly D. Becker	Own make	Chocolate.
17792	Christ. Bell	Own make	Chocolate.
17787	John A. Johnson	Own make	Chocolate.
17790	Lagos Bros	Own make	Chocolate.
17794	Stavros Peterson	Own make	Chocolate.
17783	Peter Sellis	Own make	Chocolate.
17785	Crystal Confectionery Co	Own make	Coffee
18244	Tilly D. Becker	Own make	Strawberry
17798	George Conlopoulus	Own make	Strawberry
17781	Peter Constandi	Own make	Strawberry
17796	James Ganosel	Own make	Strawberry
17791	Christ. Bell	Own make	Vanilla
17784	Crystal Confectionery Co	Own make	Vanilla
17780	Peter Constandi	Own make	Vanilla
17797	George Conlopoulus	Own make	Vanilla
17795	James Ganosel	Own make	Vanilla
17786	John Johnson	Own make	Vanilla
17789	Lagos Bros	Own make	Vanilla
17788	Prekaris Bros	Own make	Vanilla
17793	Stravros Peterson	Own make	Vanilla
17782	Peter Sellis	Own make	Vanilla
	Average		
	NORTH GROSVENORDALE.		
17751	W. B. Chandler	Nectar Products Co	Chocolate.
16850	Theophelus Donville	Own make	Strawberry
17752	W. B. Chandler	Nectar Products Co	Vanilla
16849	Theophelus Donville	Own make	Vanilla
	Average		

TABLE VII.—ANALYSES OF ICE CREAM.—*Continued.*

C.).	Dealer.	Manufacturer.	Flavor.	Fa %
	PAWCATUCK.			
12	John D. Traggis	Own make	Chocolate	12
13	John Traggis	Own make	Coffee	15
11	Charles Vardilos	Own make	Coffee	15
10	Charles Vardilos	Own make	Vanilla	15
	Average			14
	PUTNAM.			
56	Strombelis Bros	Progress Mfg Co.	Chocolate	9
50	J. E. Talbot	Own make	Chocolate	5
58	Ernest Whittemore	Smith Bros	Chocolate	10
54	James Ryan	Anderson & Patterson	Strawberry	10
53	James Ryan	Anderson & Patterson	Vanilla	12
55	Strombelis Bros	Progress Mfg. Co.	Vanilla	9
19	J. E. Talbot	Own make	Vanilla	5
57	Ernest Whittemore	Smith Bros	Vanilla	11
	Average			9
	ROCKVILLE.			
)2	John E. Gawtrey	Own make	Chocolate	4
17	Palace of Sweets	Own make	Chocolate	13
50	Mary Cuneo	Tait Bros	Coffee	9
)4	John Gawtrey	Own make	Coffee	4
)5	Mary Cuneo	Tait Bros	Pineapple	8
18	Palace of Sweets	Own make	Strawberry	14
)3	John E. Gawtrey	Own make	Strawberry	2
19	Mary Cuneo	Tait Bros	Vanilla	11
16	Palace of Sweets	Own make	Vanilla	14
)1	John Gawtrey	Own make	Vanilla	3
	Average			8
	SOMERS.			
)7	Grace Holmes	Own make	Strawberry	10
)6	Grace Holmes	Own make	Vanilla	13
	Average			11
	SOMERSVILLE.			
)9	Homer Ice Cream Co	Own make	Chocolate	10
)8	Homer Ice Cream Co	Own make	Vanilla	13
	Average			11
	SOUTH MANCHESTER.			
39	Mamacos & Ambulos	Own make	Chocolate	13
11	Mamacos & Ambulos	Own make	Coffee	14
10	Mamacos & Ambulos	Own make	Strawberry	13
38	Mamacos & Ambulos	Own make	Vanilla	14
		Average		14
	SOUTH NORWALK.			
28	New England Candy Co	Own make	Chocolate	12
26	Charles Thomas	Own make	Chocolate	12

TABLE VII.—ANALYSES OF ICE CREAM.—*Continued.*

D. C. No.	Dealer.	Manufacturer.	Flavor.
	SOUTH NORWALK—(*concluded*).		
18431	Henry Wilkins	Own make	Chocolate
18434	Henry Wilkins	Own make	Chocolate
18427	Charles Thomas	Own make	Peach
18429	Plainsted Drug Store	DeKlym	Vanilla
18425	Charles Thomas	Own make	Vanilla
18430	Henry Wilkins	Own make	Vanilla
18432	Henry Wilkins	Own make	Vanilla
18433	Henry Wilkins	Own make	Vanilla
	Average		
	SOUTHPORT.		
18262	M. R. Perry	Semon Ice Cream Co	Chocolate
18261	M. R. Perry	Semon Ice Cream Co	Vanilla
18263	M. Switzer	Horton Ice Cream Co	Vanilla
	Average		
	STAMFORD.		
18213	G K. Lawrence	Own make	Chocolate
16169	Xanthos Candy Co	Own make	Chocolate
18209	United Candy Co	Own make	Chocolate
18215	Eagle Candy Co	Own make	Chocolate
18217	Mazza & Co	Own make	Chocolate
18219	Olympia Confect. Co	Own make	Strawberry
18211	Xanthos Candy Co	Own make	Strawberry
18214	Eagle Candy Co	Own make	Vanilla
18216	Mazza & Co	Own make	Vanilla
18212	G. K. Lawrence	Own make	Vanilla
18221	G. K. Lawrence	Own make	Vanilla
18220	G. Scannalle	Own make	Vanilla
18207	Paul Sabini	Star Confectionery Co	Vanilla
18218	Olympia Confect. Co	Own make	Vanilla
18208	United Candy Co	Own make	Vanilla
18210	Xanthos Candy Co	Own make	Vanilla
	Average		
	STONINGTON.		
18698	Victor Danesi	Maine Creamery Co	Chocolate
18239	Francis D. Burtch	Own make	Chocolate
18699	Victor Danesi	Maine Creamery Co	Coffee
18697	Paul Schepis	Dolby Ice Cream Co	Coffee
18238	Francis Burtch	Own make	Vanilla
18696	Paul Schepis	Dolby Ice Cream Co	Vanilla
	Average		

Table VII.—Analyses of Ice Cream.—*Continued.*

C. No.	Dealer.	Manufacturer.	Flavor.	F
	Stratford.			
27	Stratford Candy Kitchen	Own make	Chocolate	8[illegible]
28	Stratford Candy Kitchen	Own make	Strawberry	1[illegible]
26	Stratford Candy Kitchen	Own make	Vanilla	1[illegible]
	Average			1[illegible]
	Suffield.			
67	George Martinez	New Haven Dairy	Chocolate	8[illegible]
70	F. H. Reid	Own make	Chocolate	8[illegible]
69	F. H. Reid	Own make	Strawberry	[illegible]
66	George Martinez	New Haven Dairy	Vanilla	[illegible]
68	F. H. Reid	Own make	Vanilla	10[illegible]
71	Peter Janik	Tait Bros	Vanilla	10[illegible]
	Average			[illegible]
	Thompsonville.			
10	Harry Zirolli	Tait Bros	Chocolate	[illegible]
13	Rice Bros	Own make	Chocolate	12[illegible]
14	Rice Bros	Own make	Strawberry	10[illegible]
11	Harry Zirolli	Tait Bros	Strawberry	[illegible]
15	F. Athen & J. Devine	New Haven Dairy	Vanilla	[illegible]
16	M. J. Dineen	Own make	Vanilla	1[illegible]
12	Rice Bros	Own make	Vanilla	1[illegible]
	Average			11[illegible]
	Torrington.			
45	Torrington Creamery	Own make		[illegible]
46	Torrington Creamery	Own make		[illegible]
	Average			[illegible]
	Uncasville.			
99	Pappas Bros	Own make	Vanilla	8[illegible]
	Unionville.			
04	Hackney Ice Cream Co	Own make	Chocolate	7[illegible]
65	Hackney Ice Cream Co	Own make	Chocolate	8[illegible]
61	Heiman Ice Cream Co	Own make	Chocolate	[illegible]
63	Heiman Ice Cream Co	Own make	Maple Nut	[illegible]
05	Hackney Ice Cream Co	Own make	Strawberry	6[illegible]
62	Heiman Ice Cream Co	Own make	Strawberry	11[illegible]
64	Heiman Ice Cream Co	Own make	Vanilla	10[illegible]
03	Hackney Ice Cream Co	Own make	Vanilla	[illegible]
60	Heiman Ice Cream Co	Own make	Vanilla	10[illegible]
	Average			[illegible]
	Wallingford.			
94	Ally & David	Own make	Chocolate	11[illegible]
95	Ally & David	Own make	Strawberry	11[illegible]
93	Ally & David	Own make	Vanilla	1[illegible]
	Average			1[illegible]

TABLE VII.—ANALYSES OF ICE CREAM.—*Concluded.*

D. C. No.	Dealer.	Manufacturer.	Flavor.
	WAUREGAN.		
18658	John Albro	Own make	Chocolate
17765	Harmidos Wilmot	Own make	Coffee
18657	John Albro	Own make	Vanilla
17766	Harmidos Wilmot	Own make	Vanilla
	Average		
	WEST HAVEN.		
17929	J. D. Illions	Semon Ice Cream Co	Chocolate
17931	Fred LeVere	Harris Hart Ice Co	Chocolate
17934	Nicholas Parela	Semon Ice Cream Co	Chocolate
17933	Harry Pite	New Haven Dairy Co	Chocolate
17932	Fred LeVere	Harris Hart Ice Cream Co	Strawberr
17930	Fred LeVere	Harris Hart Ice Cream Co	Vanilla
	Average		
	WESTPORT.		
18294	J. J. O'Connor	DeKlym	Chocolate
	WILLIAMANTIC.		
16839	Hallock & Holbrook	Own make	Chocolate
16846	Patrick McDermott	Horton Ice Cream Co	Chocolate
16845	Peter Yanclas	Own make	Chocolate
16840	Hallock & Holbrook	Own make	Coffee
16806	William Morris	Own make	Coffee
16841	Styles Sisters	Own make	Peach
16837	William Morris	Own make	Strawber
16838	Hallock & Holbrook	Own make	Vanilla
16835	William Morris	Own make	Vanilla
16842	Styles Sisters	Own make	Vanilla
16844	Peter Yanclas	Own make	Vanilla
	Average		
	WINDSOR LOCKS.		
17877	Charles Colli	Homer Ice Cream Co	Chocolat
17872	Louis Molinari	Peter Fossa	Chocolat
17875	Vito Colapietro	Own make	Chocolat
17876	Vito Colapietro	Own make	Maple N
17874	Vito Colapietro	Own make	Vanilla
17879	Vito Colapietro	Own make	Vanilla
17873	Louis Molinari	Peter Fossa	Vanilla
17878	Charles Colli	Homer Ice Cream Co	Vanilla
	Average		
	Average of State		

The averages given for each city or town do not of course adequately represent the true conditions in the several localities. Data as to the gross sales of the various grades is necessary to show the true average quality available. For the same reason the average for the total number of samples does not properly represent the average market condition in the State; and the double standard further complicates the calculation. The larger manufacturers have naturally standardized their products at a figure close to the legal standard and their combined output constitutes the greater part of the gross supply. Of the smaller producers many, no doubt, are unwittingly furnishing rich cream through lack of careful factory control while others may be intentionally supplying an extra quality product to a limited or special class of trade. At any rate the figures show many samples testing well in excess of 8 per cent. and the average of all samples collected is 10.1 per cent.

Forty-seven samples, or 11.8 per cent. of the total number were below standard.

Of 4 samples submitted by individuals 1 was below standard.

MILK AND MILK PRODUCTS.

Market Milk.

Ten hundred and fifty-four samples of market milk have been examined for the Dairy and Food Commissioner, classified as follows:

Not found adulterated	752	71.4%
Adulterated by dilution with water	58	5.5
Adulterated by skimming	18	1.8
Adulterated by reason of being:		
below standard in solids and solids-not-fat	100	9.4
below standard in solids and fat	19	1.8
below standard in solids, fat and solids-not-fat	107	10.1
Total	1054	100.0

The number of samples found diluted with water is conspicuously less than in preceding years. Our data with respect to the quality of milk by official inspection summarized for the periods 1913 to 1917 inclusive and 1918 to 1920 inclusive are as follows:

	Period 1913-1917.		Period 1918-1920.	
Not found adulterated	815	43.0%	2246	60.9%
Adulterated by dilution with water	276	14.5	367	9.9
Adulterated by skimming	37	1.9	131	3.6
Otherwise adulterated or below standard	770	40.6	946	25.6
Total	1,898	100.0	3,690	100.0

This summarizes the history of the inspection of market milk for the past eight years and indicates a substantial improvement in the quality of this important product. This summary does not adequately represent the general quality of the milk in the State for the reason that, as we have stated previously, official samples, in perhaps the majority of cases, are taken upon suspicion of inferiority or adulteration and in response to complaints of local milk inspectors, health officers or dairy technicians. It is reasonable to presume therefor, that the average quality of milk sold in the State as a whole is better than the above figures indicate.

Samples found adulterated during the past year, other than those below standard are given in Table VIII.

Milk Submitted by Individuals.

One hundred and two samples of milk were examined for consumers, producers and others of which seventy-five were passed and twenty-seven were adulterated or below standard. None of these require particular comment.

Cream.

Two samples were submitted by the Dairy and Food Commissioner and four by individuals.

Tester's License.

Four samples of cream and two samples of milk have been examined to check candidates for certificates as provided in Sec. 2, Chapter 221, Public Acts of 1917.

Imitation Milk, etc.

13975. *Super-Cream.* Walter Jahn's "Super-Cream" made by the Rico Milk Products Co., East Troy, Wisconsin. Stated to contain at least 24 per cent. butter fat, and 31 per cent. total solids. Price 27 cents per can containing 7.5 ozs.

Analysis showed the following composition:

	As Sold.	Diluted with 5 parts water (calc.).
Solids	31.56%	5.26%
Ash	0.67	0.11
Protein	3.06	0.51
Sugar	3.83	0.64
Fat	24.00	4.00
Net weight	7.5 ozs.	....

The composition as stated on the label is substantiated by the analysis. However, the statement, which appears on the label, that "Super-Cream can be used wherever a rich milk is desired by the addition of five parts of water" is misleading. Such dilution would yield a product which approaches rich milk only as regards

TABLE VIII.—ADULTERATED MILK.

Dealer.	Solids.	Fat.
Containing Added Water		
ANDOVER.		
Frank Swartz..........	9.93	3.4
BRANFORD.		
E. W. Caldwell.........	10.19	3.2
E. M. Yale............	10.35	3.4
E. M. Yale............	10.59	3.2
E. M. Yale............	10.83	3.4
BRISTOL.		
A. H. LaLane.........	11.27	3.4
DURHAM.		
David Bros............	10.54	3.1
David Bros............	10.66	3.2
David Bros............	11.52	3.8
David Bros............	10.77	3.2
David Bros............	9.77	3.2
ELMWOOD.		
Elmwood Catholic Ch....	9.55	3.0
MILFORD.		
Cecil Clark............	10.12	3.1
Cecil Clark............	9.86	2.8
Antonio Negosmcki.....	10.68	3.4
NEWINGTON.		
Wm. Bishop...........	10.52	3.4
Wm. Bishop...........	11.06	3.6
Wm. Bishop...........	10.68	3.3
NEWTOWN.		
Frank Valalik..........	10.71	3.2
Frank Valalik..........	10.44	3.2
Frank Valalik..........	9.87	2.6
NORWICH.		
Herbert Gardner.......	6.97	2.5
Herbert Gardner.......	11.90	4.4
John McLean..........	9.35	3.0
ORANGE.		
Benj. Hempstead.......	9.20	3.4
M. DeCaprio..........	10.61	3.2
Modestino DeCaprio....	10.59	3.2
SOUTHBURY.		
H. M. Cassidy.........	10.18	2.8
Thos. Lovedale........	11.27	3.6

No.	Dealer.	Solids.	Fat.
	Containing Added Water. —*continued.*		
	SOUTHINGTON.		
18479	Mrs. Neils Johnson.....	10.17	3.
	SOUTH NORWALK.		
18526	Fred Frillow...........	10.49	3.
	TORRINGTON.		
15629	Fred Lehman..........	11.64	4.
16617	F. B. Woodward.......	11.57	3.
16618	F. B. Woodward.......	10.98	3.
16612	Chas. Zangg...........	11.64	3.
	TRUMBULL.		
16333	Andrew Persztai........	9.63	2.
	WALLINGFORD.		
17638	Wilbur C. Fenn........	10.53	3.
17355	W. J. Self.............	9.61	3.
17356	W. J. Self.............	9.47	3.
17357	W. J. Self.............	10.30	3.
17358	W. J. Self.............	10.07	3.
17359	W. J. Self.............	10.47	3.
	WATERBURY.		
17380	D. M. Rogers..........	10.83	3.
	WATERTOWN.		
17484	John Popow...........	7.63	2.
17485	John Popow...........	8.60	3.
17486	John Popow...........	8.34	2.
17487	John Popow...........	8.86	3.
	WEST HARTFORD.		
18450	W. F. Brewer..........	9.81	2.
15540	Ralph Gerth...........	11.15	3.
18452	A. M. Morrell.........	6.93	1.
	WESTPORT.		
14986	Leonard Gault.........	10.19	3.
16397	Leonard Gault.........	9.34	3.
16398	Lenoard Gault.........	10.07	3.
16399	Leonard Gault.........	8.54	2.
16400	Leonard Gault.........	9.95	3.
	WILLIMANTIC.		
18981	John W. Gilman.......	10.33	3.
18978	L. P. Oehrig...........	9.61	2.
18979	L. P. Oehrig...........	9.61	2.

TABLE VIII.—ADULTERATED MILK.—*Concluded.*

No.	Dealer.	Solids.	Fat.
	Skimmed Milk		
	ANSONIA.		
16468	Presto Lunch..........	11.25	2.3
	EAST CANAAN.		
16545	S. Serlin...............	10.71	2.2
	DANIELSON.		
18965	W. S. Brown...........	10.22	1.7
	MOOSUP.		
18961	Joseph Cournoier.......	11.02	2.5
	NAUGATUCK.		
15692	J. Daily...............	10.79	2.3
	NEW LONDON.		
18708	Far East Lunch........	9.47	1.1
18709	New China Co.........	9.82	1.5
18704	N. Y., N. H. & H. R.R. Co.'s Restaurant.....	9.62	1.2
18718	Sea Food Lunch........	8.90	0.9

No.	Dealer.	
	Skimmed Milk—Concluded.	
	NORWICH.	
18761	Boston Cafe...........	1
18763	Wauregan Hotel.......	1
	PLANTSVILLE.	
16244	Stanley Tycz..........	'
	PUTNAM.	
18968	H. Callas & G. Anas....	1
18966	Delvina Thereault......	'
	TORRINGTON.	
15220	F. J. Barton...........	1:
	WILLIMANTIC.	
18984	H. Israel & Son........	1
18982	J. T. Nichols...........	1
18980	T. F. Shea.............	1(

fat content as shown by the calculated analysis. The dilut(product would be watered cream, not rich milk.

13175. *En-Zo.* "Imitation Milk. A compound of evaporat(skimmed milk and refined cocoanut fat". Stated to contain 6 per cent. vegetable fat and 24 per cent. total solids. Made by tl Enzo Company, Denmark, Wisconsin.

13970. *Carolene.* "A compound of refined nut oils and evap(rated skimmed milk." The label also states that the product composed of "fresh cow's milk, butter fat removed and highl refined cocoanut oil substituted", and that it contains 24 per cen solids and 6 per cent. refined nut oils. Made by The Carolene Co Inc., 130 No. Wells St., Chicago.

These products are of the same type as Hebe, a sample (which has already been examined in this laboratory.[1]

The composition of these products is shown by the followin analyses:

[1]Conn. Exp. Sta., Bulletin 210, p. 224 (1918).

Number	13175	13970
Solids	23.19%	24.86%
Ash	1.50	1.59
Protein	6.76	6.89
Sugar	8.79	10.48
Fat	6.14	5.90
Constants of fat:		
Butyro-refractometer at 40°C.	36.8	36.00
Reichert-Meissel No.	9.2	.....

Milk Powder.

Four samples of milk powders have been examined.

Klim brand, Powdered Whole Milk, **14412**; Klim brand, Powdered Skimmed Milk, **14413**; and Powdered Modified Milk, **15037**, for infant feeding, all made by the Merrell-Soule Co., Syracuse, N. Y.

Powdered Skimmed Milk, **14809**, made by the National Dry Milk Co., Dacoming, Wisconsin.

Products of this class examined by us in previous years have been summarized in an earlier Bulletin[1] from this laboratory.

Analyses of the products examined this year are as follows:

Table IX.—Analyses of Milk Powders.

	14412	14413	15037	14809
	%	%	%	%
Moisture	3.23	4.00	2.76	5.03
Ash	5.98	8.23	7.15	7.88
Protein (N x 6.38)	24.88	33.55	17.23	33.36
Lactose (by difference)	37.75	53.08	53.52	53.03
Fat	23.16	1.14	19.34	0.70
Acidity (as lactic acid)	....	....	0.85	1.72

In case of the whole milk powder it is directed to take eight special measures to one quart of water to make one quart of whole milk. Provided the powder is so measured as to obtain four and one-half ounces a milk of good quality will be secured. To do this however, the special measure which accompanies the package must be rather closely packed.

The analysis of the modified milk powder is substantially as stated on the label of this product.

Malted Milk, etc.

Six samples of products of this class have been examined. The brands include Borden's **13967**; Horlick's **13969**; and two products made by Thompson's Malted Food Co., Waukesha, Wisconsin, viz., Thompson's Malted Milk, **13579, 13968** and Thompson's Hemo, **13580, 14260.** Hemo is stated to consist of the combined extractives of barley and selected wheat, pastuerized milk, beef peptones and hemoglobin.

Analyses of these products are as follows:

[1]Conn. Exp. Sta., Bulletin 213, p. 406 (1919).

TABLE X.—ANALYSES OF MALTED MILK, ETC.

Number	**13967**	**13969**	**13968**	**13579**	**13580**	**14260**
Moisture	2.55%	3.05%	4.04%	3.72%	2.74%	...
Ash	2.93	3.80	3.80	4.32	4.65	...
Protein	14.38	15.06	10.00	12.75	13.50	...
Fiber	0.45	0.40	0.26	0.12	0.09	...
Nitrogen-free extract	70.71	69.59	74.69	73.59	73.62	...
Fat	8.98	8.10	7.12	5.50	5.40	...
Starch	none	none	none	trace	none	...
Iron (Fe.)	0.0013	0.0020	0.0002	....	0.0013	0.0050

Hemo contained 1.86 per cent. of water-soluble nitrogen distributed as follows: coaguable 0.87, precipitable by tannin-salt 0.83, residual 0.16. Malted milk, **13968**, contained 1.47 per cent. of water-soluble nitrogen distributed as follows: coaguable 0.83, precipitable by tannin-salt 0.49, residual 0.14. In the case of Hemo about 45 per cent. of the water-soluble nitrogen was precipitated by tannin-salt while in malted milk about 33 per cent. was precipitated by the same reagent indicating a larger proportion of nitrogenous substances of the peptone group in Hemo. It is understood, however, that tannin-salt is not a specific reagent for peptones, but precipitates other intermediate digestion products of protein such as proteoses, polypeptides, etc. The comparative figures given above are interesting, but the data is insufficient as a basis for any general conclusion.

Hemoglobin is the coloring matter of blood-corpuscles and is conspicuous for its iron content. The comparative figures for iron in the analyses given above show in one sample of Hemo no more iron than was found in Borden's malted milk; the second sample, **14260**, shows substantially more. Again the figures are suggestive rather than conclusive on account of limited data. According to analyses available in the literature the iron content of milk itself shows wide variations due in part no doubt to analytical differences.

The method we have employed for the determination of iron is as follows:[1]

Standard solution: Dissolve 0.7 gram of crystallized ferrous ammonium sulphate in 50 cc. of distilled water, acidify with 20 cc. of dilute sulphuric acid, heat slightly, add N/10 potassium permanganate until a faint pink color is obtained and dilute to a volume of 1000 cc. One cc. of this solution is equivalent to 0.0001 gm. of Fe. Prepare a series of standards using 1, 2, 3, etc., cc. of this solution to which is added 5 cc. of a solution of potassium thiocyanate (1:50) and dilute to a volume of 50 cc.

Determination: Burn 10 grams of sample in a platinum dish avoiding excessive heat. Add 5 cc. of conc. hydrochloric acid to dissolve the ash, transfer to a 100 cc. flask, add sufficient N/10 potassium permanganate to produce a faint pink color and dilute to volume. Filter if necessary. Take an aliquot of 40 cc. (= 4 gms. original material) add 5 cc. of potassium thiocyanate and dilute to 50 cc. Mix and compare with standards.

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[1]Standard Methods of Water Analysis. Am. Public Health Asssoc., 1917, p. 44.

HUMAN MILK.

Fourteen samples of breast milk have been examined chiefly at the request of physicians and of the Visiting Nurse Association of New Haven. The value of these analyses is entirely dependent upon whether or not the samples are representative. All of the milk available at the time of feeding should be drawn and thoroughly mixed before sampling. The variations in composition between so-called 'foremilk', 'middlemilk', and 'strippings' from cows is well known. Söldner[1] has shown what these variations may be in the case of milk drawn from the human milk gland. In the following tabulation, Table XI, the first, second and third portions correspond to the fractions just indicated.

TABLE XI.—COMPOSITION OF DIFFERENT PORTIONS OF HUMAN MILK.

Sample.	Portion.	Weight of portion gms.	Solids. %	Protein (Nx6.38). %	Fat. %	Sugar. %	Ash. %
17	1st	33.1	8.82	1.15	1.71	5.50	0.46
	2nd	33.3	9.75	0.96	2.77	5.70	0.32
	3rd	57.3	10.72	0.83	4.54	5.07	0.28
67	1st	48.3	9.87	0.89	1.94	6.82	0.22
	2nd	30.3	14.11	0.89	3.07	9.92	0.23
	3rd	40.1	11.74	1.08	4.58	5.87	0.21
93	1st	39.6	8.44	1.08	1.23	5.97	0.16
	2nd	37.9	9.66	0.89	2.50	6.03	0.24
	3rd	41.9	12.17	0.89	4.61	6.43	0.24
118	1st	30.0	9.02	1.08	2.54	5.17	0.23
	2nd	22.5	10.42	1.02	3.98	5.17	0.25
	3rd	31.8	13.70	1.08	7.20	5.17	0.25

It is at once evident from these figures that the variations are chiefly due to fluctuations in fat content; and that no adequate idea of the substance and quality of the milk supply can be obtained unless the entire secretion of the gland is drawn and mixed before sampling. Thus the fat content of the entire yield in case of sample 17 is 3.22 per cent.

Analyses of the samples submitted during the past year are given in Table XII.

TABLE XII.—ANALYSES OF HUMAN MILK.

Station No.	Solids %	Protein (N x 6.38). %	Fat. %	Sugar. %	Ash. %
13634	14.10	1.37	5.8	6.73	0.20
14295	10.39	1.24	1.6	7.32	0.23
14296	...	2.23	2.64	....	....
14353	...	...	2.50	....	0.31
14398	12.95	1.72	4.0	7.00	0.23
14632	10.80	1.28	2.0	7.29	0.23
14942	15.59	...	6.9	..	0.19

[1]Lane-Claypon, Milk and Its Hygienic Relations, p. 23.

TABLE XII.—ANALYSIS OF HUMAN MILK—*Continued.*

Station No.	Solids	Protein (N x 6.38).	Fat.	Sugar.	Ash.
	%	%	%	%	%
14969	13.14	1.28	4.5	7.11	0.25
15105	14.77	1.50	5.3	7.75	0.22
15016	13.34	1.46	3.7	7.94	0.24
15172	...	...	4.0	...	...
15180	...	1.21	6.8	...	...
15221	12.17	1.02	3.8	7.17	0.18
15295	12.20	1.08	3.6	7.31	0.21

SYRUPS.

Two samples of bakers' syrups were examined.

14202. *Syromal.* It was found to contain 50 per cent. of cane sugar and 16.6 per cent. of invert sugar as determined by copper reduction methods. Polarizations at 20°C. were direct +36.3°, invert—10.4°.

14203. *Syrup,* claimed to be made of cane syrup, honey and acetic acid. It contained 42.8 per cent. of cane sugar and 30.2 per cent. of invert sugar. Polarizations at 20°C. were direct ±0°, invert —20.0°.

TEA.

No samples of tea were examined during the past year for inspection purposes, but methods for the determination of caffein were further studied and the results included in the report of the writer as Referee on tea to the Association of Official Agricultural Chemists at their annual meeting in November 1920.

The Power and Chestnut method[1] was studied and recommended to the Association as an official method. The Stahlschmidt method[2] which is now tentative, was further modified[3] so that caffein residues of a high degree of purity can be obtained. A new proceedure was also evolved[4], based upon the two methods just mentioned and the Deker[5] method, which has thus far been found to give satisfactory results and which is rapid and simple to manipulate. The two last named methods are being submitted for collaborative study with a view to the adoption of one or the other as an optional official method.

The proposed new method is as follows:

Preparation of sample: Grind the tea to pass a 1/25 inch sieve.

Assay: To 5 grams of material in a 500 cc graduated flask add 10 grams of heavy magnesium oxide and 200 cc. of distilled water. Boil gently over a low flame for two hours using a small bore glass tube 30 inches long as a condenser. Cool, dilute to volume and filter through a dry paper. Take an aliquot of 300 cc., equivalent to 3 grams of original material in

[1]Jour. Am. Chem. Soc., **41,** 1300.
[2]Jour. A. O. A. C. **2,** 3, 332.
[3]By C E. Shepard and the writer.
[4]By R. E. Andrew and the writer.
[5]Chem Zentr **1,** 1, 62, 1903.

an erlenmeyer flask of 1,000 cc. capacity, add 10 cc. of a 10 per cent. solution of sulphuric acid and evaporate by gentle boiling until the volume is reduced to about 100 cc. Filter into a separatory funnel washing the flask with small portions of 1 per cent. sulphuric acid, and shake out six times with chloroform using 25, 20, 15, 10, 10, 10 cc. portions. Treat the combined extracts with 5cc. of a 1 per cent. solution of potassium hydroxide. When the liquids have completely separated draw off the chloroform layer into a suitable flask or beaker. Wash the alkaline solution in the separatory with two portions of chloroform of 10 cc. each and unite the washings with the main bulk of extract. Evaporate or distill off the chloroform to small bulk, transfer to a tared flask, evaporate to dryness, and further dry in a water oven at 100°C. to constant weight.

If desired, transfer the residue thus obtained to a digestion flask with successive small portions of sulphuric acid and determine nitrogen by the Kjeldahl method, calculating caffein from nitrogen by the factor 3.464.

The results obtained by the several methods are given in Table XIII.

TABLE XIII.—CAFFEIN IN TEA.

	Stahlschmidt Method.		Power and Chestnut Method.		Proposed Method.	
	By weight.	From N.	By weight.	From N.	By weight.	From N.
	%	%	%	%	%	%
Black tea, 4...	2.83	2.81	3.06	2.99	2.98	2.86
	2.89	2.87	3.05	3.03	2.94	2.87
	2.86	2.84	3.05	2.95	2.92	2.82
	....	....	....	....	2.80[1]	2.80[1]
	....	....	....	....	2.84[1]	2.80[1]
Green tea, 5...	1.64	1.63	1.61	1.55	1.70	1.61
	1.65	1.59	1.69	1.60	1.66	1.58
	....	....	....	....	1.77	1.66
	....	....	....	....	1.57[1]	1.52[1]
	....	....	....	....	1.62[1]	1.57[1]
Green tea, 9...	2.09[2]	1.94	2.12	2.01	2.14	2.08
Black tea, 10..	2.71[2]	2.63	2.69	2.67	2.62	2.62
Black tea, 12..	3.10[2]	2.96	3.20	3.12	3.00	2.93
	....	....	....	....	3.15	3.03
	....	....	....	....	3.12	2.99

Satisfactory methods[3] have been worked out for caffein in coffee but we have been interested to try the proposed method on that substance. In two samples tried we have obtained the following results:

Sample No.	Power and Chestnut Method. By weight.	Power and Chestnut Method. From N.	Proposed Method. By weight.	Proposed Method. From N.
	%	%	%	%
15409..................	1.51	1.47	....	....
	1.49	1.45	1.61	1.49
15410..................	0.21	0.17	....	....
	0.21	0.18	0.28	0.24

[1]Results by H. A. Lepper.
[2]Not purified by treatment with potassium hydroxide.
[3]H. A. Lepper, A. O. A. C. Referee on Coffee, Report of 1920.

Sample **15410** was a decaffeinated product. The results suggest that the method is probably applicable also to coffee.

VINEGAR.

One sample of vinegar submitted by the Dairy and Food Commissioner and nine by individuals have been examined for total solids and acidity. Three were found deficient in one or both particulars and seven were passed. The alcohol content of one of the samples was asked for. No alcohol was found as, of course, should be the case in the well made product.

MISCELLANEOUS MATERIALS.

Foods, Etc.

Five samples of miscellaneous food products collected by the Station agent and 8 submitted by individuals have been examined.

13954. *Ice cream cones*, made by the Repeater Cone Co., Cheshire, Conn., were found to be free from saccharin and preservatives. They contained: moisture 8.14 per cent., ash 1.05 per cent., protein 7.00 per cent., fat 1.02 per cent., nitrogen-free extract and fiber 82.79 per cent.

13977. *Orangeade Paste*, prepared by Emma Curtis, Melrose, Mass., The preparation is stated to contain fruit flavor and artificial color. It was found to contain 79.43 per cent. of solids, 68.70 per cent. of sugar (expressed as invert sugar), natural fruit flavor and a permitted color, Orange I. No preservative was found. This product has been examined once before[1] in this laboratory with substantially the same results.

13942. *Vanilla Paste*, made by Gra-Rock Products Co., Canton, Conn. Contents of one tube stated to be equivalent to 1 pint of liquid extract. No weight was given but the contents (squeezed out) weighed 36.7 grams. When mixed with a pint (473cc.) of water the solution or emulsion contained 0.01 gram of vanillin per 100 cc. equivalent to 0.13 per cent. in the original paste. The paste consists essentially of gum, glycerine and sugar with a small amount of vanillin. Vanilla extract of standard quality contains in 100 cc. the soluble matter from not less than 10 grams of vanilla bean[2]. The amount of vanillin obtained from 10 grams of vanilla bean will depend upon the quality of the bean and may vary from 0.07 to 0.24 gram[3]. However, this paste contained 0.047 gram of vanillin while the least amount that a pint of vanilla extract may be expected to contain is about 0.33 gram. We are advised that the manufacture of this product has been discontinued.

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[1]Conn. Exp Sta. Bull. 219, p. 240 (1919).
[2]Standards of Purity for Food Products, U. S. D. A. Cir. 136, (1919).
[3][illegible]

13979. *Cherry Fam-ly-ade*, and **13978**, *Raspberry Fam-ly-ade*, made by the Fruit Valley Corporation, Rochester, N. Y. Each of these preparations was contained in a two-compartment glass vial; one solution consisted of, or contained, the color and sugar and the other (smaller) contained the flavor. The flavoring solution of **13979** contained 1.67 grams of benzaldehyde per 100 cc. while the flavor of **13978** appeared to be citric acid with some natural raspberry.

14391. *Baking Powder*, was found to be of standard quality as regards available carbondioxide, of which it contained 12.89 per cent.

15072 and **15165.** *Cheese*, two samples, contained 36.35 per cent. and 32.38 per cent. of moisture respectively.

15385 and **16168.** *Honey.* The samples were suspected of containing added glucose but no evidence of adulteration was found.

14170. *Orange Marmalade*, was suspected of containing artificial sweetener. No saccharin or glucose was found.

14402. *Pepper* (white), thought to contain a large amount of foreign material, conformed to the standards for white pepper. The sample contained moisture 9.03 per cent., ash 1.24 per cent., nitrogen 2.15 per cent., crude fiber 4.23 per cent., ether extract 7. 75 per cent. and ash insoluble in acid 0.10 per cent.

15170. *Surface Water*, was submitted for examination for an explanation of a scum thought to be oil. Examination showed, in parts per million, solids 320, loss on ignition (organic) 143, and mineral matter 177. Qualitative tests for iron were strong and there was no indication of oil. The fluorescent scum was due probably to organic iron compounds.

Wines, Liquors, Etc.

Ninety-one samples of alcoholic beverages have been examined for alcoholic content, or the presence of methyl (wood) alcohol, or both. The samples have been submitted chiefly by physicians, health and police officials and Prohibition Enforcement agents; and a considerable number of them have been examined by the writer as State Chemist.

Among these samples were eight taken from stock seized by Police and Detectives of Hartford in connection with the sale and consumption of "poison whiskey" which resulted in numerous deaths in that city and neighboring cities during the Christmas Holidays of 1919. On the day of the seizures samples were turned over to this laboratory where the nature of the deadly mixture was discovered and reported to the prosecutor. Of the eight samples six contained from 31.7 to 47.7 per cent. of pure methyl (wood) alcohol, one was fusel oil, used to imitate the whiskey flavor and one was genuine whiskey. Prosecutions which resulted developed the following history: A consignment of 1,000 gallons of

methyl alcohol shipped from a distillery in Michigan to a firm in London, England to be used for technical purposes and plainly marked, was stolen in Brooklyn, N. Y., while in transit, and distributed by a gang of bootleggers for beverages purposes. Three barrels found their way into this State with the results already stated, and had it not been for the prompt action of the Hartford authorities much greater disaster would have resulted.

This unfortunate affair naturally threw suspicion for a time upon all alcoholic liquors which accounts in part for the unusual number of samples submitted.

Other Materials Examined for Poisons, Etc.

Fourty-five samples of miscellaneous materials have been submitted by individuals or public officials to be examined for poisons or suspicious substances. In nine of these, examinations revealed or suggested the probable cause of the symptons or results noted.

14503. *Cake* with cocoanut frosting. The cake was suspicious because the cocoanut turned intensely pink after 24 hours. The pink color was extracted from the cocoanut and shown to be a dye, but not identified. A similar color was extracted from the cake itself. The reaction of the cocoanut on the bottom layer which was overlaid with the alkaline cake did not turn pink. It appeared that the cocoanut absorbed from the cake a color which developed a pink shade in presence of an acid.

14851. *Cider Vinegar.* This was reported to have made several persons ill. A large or considerable amount of arsenic was found.

14292. *Viscera of two geese and a duck.* The birds had died suddenly. Qualitative tests indicated considerable amounts of yellow phosphorus.

14394. *Milk and cereal* mixture prepared for feeding an infant. The sample submitted weighed 180 grams and contained 36 grains of carbolic acid. This amount would no doubt have proved fatal if it had been fed. It is recorded that 22 grains proved fatal to an adult.

14900. *Intestinal contents of a pig.* Large quantities of antimony were found.

15241. *Crystalline substance* found in bottle of milk. It proved to be potassium alum.

14452. *Old Fashioned Brown Sugar.* Complaint was made that an insoluble substance formed when milk was used with it in making candy. It was found that the sugar had an acidity requiring 14 cc. of N/10 alkali to neutralize it. When milk containing this sugar was boiled a coagulum formed. Milk containing the neutralized sugar formed no coagulum on heating. Directions were given for neutralizing the sugar with sodium bicarbonate to obviate the difficulty.

D. C. No. **18409.** *Domino Old Fashioned Brown Sugar.* Complaint was made similar to that in case of **14452.** A sample of the "insoluble substance" was submitted which was found to contain a considerable amount (2 per cent.) of nitrogen. Acidity was not determined but the explanation is doubtless the same as that already stated for the previous sample.

14201. D. C. Nos. **16501** and **18402.** *Rainbow Sugars.* The colors found were amaranth, indigo, carmine and tartrazine, all permitted colors.

15020. *Well Water.* A sediment in the water was shown to be iron rust or scale.

The remainder of the samples require no comment.

II. DRUGS, ETC.

PROPRIETARY REMEDIES.

Five preparations of this class have been examined.

13167. *Bliss Native Herbs*[1]. The Alonzo O. Bliss Medical Company, Washington, D. C. The remedy is stated to be free from opiates, narcotic drugs and mineral poisons. Forty-five cents was paid for a box of 67 tablets.

Examination and analysis show the following composition:

Average weight of tablets 0.34 gram; reaction faintly acid; taste bitter. Analysis, parts per hundred: moisture 4.16 ash 6.43 (sulphates, trace, calcium, magnesium and phosphates, considerable); nitrogen 1.00; aloes and licorice present; ginger and cassia indicated; capsicum?; alkaloids none.

13171. *Kalpho,* prepared by the Parker Biochemic Company, New York. Nature's nerve tonic for the treatment of nervousness, sleeplessness, brain fag, etc.; a natural nerve food; contains no harmful nor habit-forming drug. Such are statements taken from the advertising literature.

Examination and analysis show the following composition:

Average weight of tablets 0.074 gram. Analysis parts per 100: moisture 0.08; ash 0.05 (calcium, sulphates and phosphates none or trace); iodides and bromides none; lactose, hydrated 97.7; extractives with ether from acid and from alkaline solutions, 0.12 and 0.03 respectively; extractives with chloroform from acid and from alkaline solutions 0.10 and 0.05 respectively; tests for alkaloids negative.

The tablets consist of milk sugar probably treated with some medicament in homeopathic dilution. We find no harmful drugs, or anything else of apparent potency.

13168. *Caldwell's Syrup Pepsin and Herb Laxative Compound.* The Pepsin Syrup Co., Monticello, Ill. Five fluid ounces cost 55 cents.

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[1]See also Street, Patent and Proprietary Medicines, p. 36.

Examination and analysis show the following composition:

Specific gravity at 15.6 °C. 1.200; alcohol by volume 5.30 per cent. The following constituents are in grams per 100 cc. Solids 52.81; ash 0.46 (calcium and magnesium present, phosphates and sulphates trace); invert sugar 1.54; sucrose 50.03; emodin-like substances present, senna indicated; salicylic acid (or salicylates) present; ether extractives from acid solution 0.216; chloroform extractives from alkaline solution, 0.026. Cloves and cinnamon flavor.

13172. *Cinot,* made by the Cinot Syndicate, Chicago, and extensively advertised as the Wonder Medicine of the Age. $1.20 was paid for a bottle of 8 fluid ounces.

Examination and analysis show the following composition:

Specific gravity at 15.6°C. 1.0553; alcohol by volume 0.20 per cent. Other constituents are in grams per 100 cc. Solids 13.79; ash 1.22 (phosphoric acid 0.04, sulphur trioxide, 0.10 calcium oxide 0.21, magnesium oxide 0.07); invert sugar 3.29; sucrose 4.22; vegetable material other than sugar 5.06; ether extractives from acid solution 0.67; emodin-like substances present, rhubarb indicated; salicylic acid (or salicylates) present; chloroform extractives from alkaline solution 0.024; alkaloids trace? not indentified.

The preparation is an aqueous solution containing about 14 per cent. of solids one-half of which is sugar and the remainder mineral and vegetable matter consisting of, or containing cathartic drugs including rhubarb. Aside from any efficacy the salicylate may have as a rheumatism remedy it also serves the more useful purpose (to the manufacturers) of preserving the liquid in the enforced absence of an appreciable amount of alcohol.

Possibly the secret of the wonderful remedial effects which are said to follow the use of this medicine is to be found in the literature contained in the package where we read in the directions "Drink plenty of water."

13170. *Allenrhu.* Made by the Alle-Rhume Remedy Co., Rochester, N. Y. Indicated for all conditions of rheumatism, etc. Price $1.50 for 16 fluid ounces.

Examination and analysis show the following composition:

Specific gravity at 15.6°C. 1.0848; alcohol none; the following constituents are in grams per 100 cc.: solids 13.93; ash 6.64 (phosphoric acid 1.72, sulphur trioxide 1.84, calcium and magnesium present); ether extractives from acid solution 0.82 (salicylic acid 0.76); chloroform extractives from alkaline solution 0.01; alkaloids trace?; invert sugar 1.90 sucrose 1.00; organic material (non-sugars) 4.39; emodin-like substances none.

The preparation is an aqueous solution of mineral salts, salicylic acid (or salicylates) with sugar and other organic material. The usual laxative vegetable drugs are not indicated.

SOAP.

Fats and oils are essentially combinations of fatty acids and glycerol. When treated with caustic alkali they undergo a definite chemical process (saponification) whereby the acidic portion of the fat or oil combines with alkali, glycerol is liberated and a soap is formed. In broad terms any metallic salt of a fatty acid is a soap; thus lead, zinc, calcium or magnesium soaps are made and have special uses. But the soaps of household use are the alkali-metallic (sodium or potassium) salts of fatty acids, and it is to this class that the term soap is generally restricted.

Taking as an example a common fat, 890 parts of stearin treated with 120 parts of caustic soda yield 918 parts of sodium soap and 92 parts of glycerol. Incidentally this shows an important reason for the war time economy in the use of fats since about one-tenth of the weight thereof is glycerol which is an essential in the manufacture of munitions.

The art of soap making is of ancient origin, but its chemistry is comparatively modern. Pliny describes a product made from goat's tallow and wood ash lye, and the treatment of fats in this manner is not entirely forgotten in the present day.

Both the character of the fat or oil used and the kind of alkali employed will determine the nature and quality of the resulting soap. The solid vegetable or animal fats, or fatty acids therefrom, with sodium produce hard soaps, while fish and vegetable oils with potassium yield soaps of softer variety. But with the same oil or fat the soap formed by the use of sodium is harder than that formed when potassium is the saponifying agent.

The soaps of sodium and potassium are soluble in water, in which particular they differ from the soaps of other metals and to which they owe their practical importance. The soaps of calcium and magnesium are insoluble and advantage is taken of this fact to distinguish hard waters. If a soluble soap becomes insoluble in water from a particular source it indicates the presence of lime or magnesia to which the hardness of water is due.

So-called marine or salt water soaps are sodium soaps of palm nut or cocoanut oils. They are not rendered insoluble by dilute brine solutions and hence a lather can be produced with them in sea water.

The most important property of soap is its detergent or cleansing action to explain which several theories, none entirely conclusive, are offered. Considerable emphasis has been given to the action of free alkali resulting from hydrolysis of the soap in solution. Mechanical affect has been advanced as an explanation based on the readiness with which soap removes mineral oils from metal surfaces. Since mineral oils do not saponify the chemical factor is eliminated in this instance. Probably the complete explanation includes also a consideration of the Brownian movement or pedisis of the lather, the formation of adsorption

compounds and the peculiar properties of colloidal solutions, of which soap in a water "solvent" represents a type.

Judgment of the quality of soap depends upon the purpose for which it is intended. Free alkali should be absent in toilet soap but it is permissible, and in limited amount, advantageous in soaps for scouring and manufacturing purposes. As a rule the less extraneous matter a soap contains the better its quality but there are exceptions such, for example, as the addition of starch to soap for use on woolen or silk fabrics. Insoluble earthy matters, unless for abrasive purposes, are regarded as adulterants; but alkali carbonates, silicates and borates are permissible on account of their detergent properties.

The detailed analysis of soap presents numerous difficulties, some of which are pointed out by Low[1] in a discussion of proposed standard methods of soap analysis. The complex nature of even the common types of laundry soap makes it impossible to show their exact chemical composition by the ordinary uniform methods of systematic analysis. We have attempted, however, to gain a general idea of the substance and quality of the soaps examined by determining the more conspicuous constituent groups by methods generally employed. The samples herein reported have been examined in two different years and the methods used in case of the older samples differ in some respects from those used in later examinations. The methods used in 1919 were based upon those outlined in Allen[2], Sadtler[3], Lewkowitsch[4] and the Bureau of Standards[5]. More recent tentative standard methods[6] have been followed in part in case of samples examined in 1920.

Methods of Analysis.

Preparation of sample: Reduce one transverse half of the solid cake to thin shavings or, if possible, run the entire cake through a food chopper, mix well and place in a tightly stoppered container.

Water (and volatile): Dissolve 2 grams of the sample in the smallest possible amount of hot 95 per cent. alcohol. Completely absorb the alcoholic solution of soap with recently ignited asbestos contained in a flat bottom dish, the dish and asbestos being first accurately tared, evaporate on a steam bath and finally dry to constant weight at 100°C.

It was found that practically constant weights were obtained after 5 hours drying except in case of soaps containing large or considerable amounts of glycerin. Since many soaps contain appreciable quantities of glycerin and soaps generally, particularly laundry soaps, contain it to some extent, a method of drying in a vacuum over sulphuric acid at room temperature was tried. This alternate proceedure is as follows:

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[1]Jour. Ind. Eng. Chem, **11**, 12, 1169. (1919).
[2]Commercial Organic Analysis, 4th Ed., **2**, 422 et seq.
[3]Industrial Organic Chemistry, p. 85.
[4]Chem. Technol. and Analysis of Oils, Fats and Waxes.
[5]U. S. Dept. Commerce, Bureau of Standards, Circ. 62.
[6]Jour. Ind. Eng. Chem. **11**, 8, 785.

Weigh 2 grams of the sample into a shallow dish, provided with a tight fitting cover to prevent absorption of moisture while weighing the dried sample, place in a desiccator over sulphuric acid, exhaust, and allow to stand for 24-hour periods agitating the surface of the acid occasionally by gentle shaking.

The weight was found to be constant at 96 hours and a shorter period was generally sufficient. Comparative losses by these two methods of drying are given in the following tabulation.

Sample No.	Loss on Drying. Water oven at 100°C.	Loss on Drying. In vacuum at room temp.	Remarks.
	%	%	
13182	4.63	4.63	....
13185	9.92	8.23	Glycerin claimed.
13186	5.02	4.76	....
13187	10.16	7.37	Glycerin claimed.
13188	4.55	4.25	....
13189	13.31	8.29	Glycerin claimed.
13190	5.11	3.87	Glycerin?.
13191	11.21	6.70	Glycerin claimed.

The results by the two methods are seen to agree reasonably well unless glycerin is present. Sample **13190** may have contained this constituent. Neither method represents the true water content of the soaps as considerable volatile matter other than water is lost at the higher temperature while water itself in combinations with certain alkali salts (carbonates and silicates) probably remains in either case.

Unsaponified and unsaponifiable matter: Transfer the dry residue, obtained in the determination of water, to an extraction tube and extract with petroleum ether for sixteen hours in a continuous extraction apparatus. Evaporate the solvent and dry the residue at 100°C. This will give *free fatty acids*, if present, *neutral fat*, and *unsaponifiable matter*. Deduct from this figure the per cent. of free fatty acids as determined subsequently by titration.

Free alkali and free acid: Dissolve 2 grams of the sample in hot neutral 95 per cent. alcohol, filter through a Gooch crucible, wash with the solvent and add a few drops of phenolphthalein to the filtrate. If the reaction is alkaline titrate with N/10 acid and express the result as per cent. of sodium hydroxide. If the reaction is acid titrate with N/10 alkali and express as per cent. of oleic acid (1 cc. of N/10 alkali is equivalent to 0.0282 gram oleic acid).

Alkalinity due to carbonates, silicates and borates: Exhaust the residue in the crucible (obtained in the previous determination of free alkali or free acid), by repeated additions of boiling water, transfer to a 100 cc. volumetric flask, cool and make up to volume. Titrate an aliquot with N/10 acid, using methyl orange as an indicator. The result is the alkalinity due to carbonates, silicates, etc., and is expressed in terms of per cent. of sodium oxide, Na_2O.

Material insoluble in alcohol and in water: Wash the residue still remaining in the crucible (from the previous determination), with a little alcohol and ether, dry at 100°C. and weigh.

Fatty (and resin) anhydrides: In our first analyses Method A was used. Since then Method B has been published[1] and this proceedure was followed in case of samples examined in 1920.

(A) Dissolve 2 grams of sample in 50 cc. of hot water in an Erlenmeyer flask, add 20 cc. of N/2 sulphuric acid and heat on the steam bath until the fatty acids form a clear layer on the surface of the solution. Bring the fatty acids up into the neck of the flask with hot water, and allow to cool. Loosen the hardened fatty acids and, without removing them, filter off the acid solution, saving the same for subsequent titration to determine total alkali. Add 50 cc. of hot water to the fatty acids in the flask and heat again until they form a clear layer, finally bring them into the neck of the flask and allow to harden. Mechanically remove the plug of hardened fatty acids to a small tared beaker. Pass the aqueous solution through the same filter previously employed and combine the filtrate with the previous one saved for the determination of total alkali. To the main portion of fatty acids in the tared beaker add any particles which have accumulated on the filter. If any traces adhere to the sides of the original flask, rinse out the dry flask with small portions of petroleum ether and add the washings to the tared beaker. Evaporate off the solvent, dry at 100°C and weigh. Deduct from this weight the total petroleum ether extract (which included free fatty acids, unsaponified fat, and unsaponifiable matter), and obtain the weight of fatty and resin acids combined as soap. The factor 0.97 has been used to convert figures for fatty and resin acids to their anhydrides although for certain oils this may be inaccurate.

Note. In some cases the fatty acids are liquid or semi-liquid at room temperature. In such instances weigh out 2 grams of dry beeswax and add it to the soap solution. The separated fatty acids will become incorporated with the wax and form a cake. Correct the final weight for the weight of the wax added.

(B). Dissolve 5 grams of soap in 100 cc. of water in a weighed 400 cc. Erlenmeyer flask. When completely dissolved add dilute sulphuric acid in slight excess, place a funnel in the neck of the flask and heat on a steam bath at a temperature not above 80°C until the fatty acids form a clear oily layer. Cool and transfer both fatty acids and acid water to a separatory funnel washing out adhering fat from the flask with petroleum ether (B. P. not over 65°C) using about 50 cc. of solvent. Shake out the fatty acids, avoiding too vigorous agitation, and allow the liquids to separate. Draw off the acid solution. Wash the petroleum ether layer in the separatory with three 25 cc. portions of water adding the washings to the acid solution first separated. Extract the acid solution with petroleum ether in 50, 25, and 25 cc. portions, unite the three extracts and wash with water as in case of the original petroleum ether solution. Filter the original petroleum ether solution and the petroleum ether extracts of the acid washings, both of which are now free from water-soluble impurities, through a paper wet with petroleum ether into a tared flask of suitable capacity provided with a stirring rod. Wash the filter free from fatty acids. Add 100 cc. of freshly boiled neutral 95 per cent. alcohol to the filtrate and titrate with N/10 sodium hydroxide to neutrality using phenolphthalein as an indicator. Calculate Na_2O as soap after deducting for free fatty acids in the original soap. Evaporate the neutral petroleum ether-alcohol solution to dryness breaking up any lumps of soap that may form by means of the stirring rod provided for the purpose. Dry to constant weight at a temperature not over 105°C and express the result as *soda soap* (unsaponified and unsaponifiable matters are included

[1]Tentative Standard Methods for the Sampling and Analysis of Commercial Soaps and Soap Products. Jour. Ind. Eng. Chem., 11, 8, 785-88, (1919).

and should be deducted if separately determined). Deduct the weight of sodium oxide (Na_2O), already calculated, from the weight of soda soap to obtain the weight of *fatty anhydride.*

The data on thirty-eight samples of laundry and toilet soaps are summarized in Table XIV.

There are no official specification or standards for soap in this State. Standards formulated by various Government Departments and by private enterprises differ considerably in their requirements but the following specifications relating to laundry and toilet soaps may be quoted from a set of Government regulations:[1]

Laundry Soap, (for use with soft water). Moisture must not exceed 20 per cent.; volatile matter at 105°C. not more than 34 per cent.; free alkali (as NaOH) not more than 0.2 per cent.; alakline salts, as Na_2CO_3, not more than 1.0 per cent.; insoluble in water not more than 0.1 per cent.; rosin not more than 15 per cent.

Laundry Soap (for use with moderately hard water). Moisture must not exceed 20 per cent.; volatile at 105°C., not more than 34 per cent.; free alkali, as NaOH, not more than 0.5 per cent.; alkaline salts, as Na_2CO_3, not more than 6 per cent., nor less than 2.0 per cent.; insoluble in water not more than 0.5 per cent.; rosin not more than 25 per cent.

Milled (Toilet) Soaps. Volatile matter at 105°C. must not exceed 15 per cent.; free alkali, as NaOH, not more than 0.1 per cent.; alkaline salts, as Na_2CO_3, not more than 0.3 per cent.; insoluble in water nor more than 0.1 per cent.

White Floating Soap. Volatile matter at 105°C. must not exceed 34 per cent.; alkaline salts not more than 0.5 per cent.; otherwise the same as for milled soap.

Elsewhere[2] it is stated that a good grade of laundry soap will contain not less than 60 per cent. of fatty acids and not more than 0.5 per cent. free (caustic) alkali. Toilet soap should be free from caustic alkali, should not contain excess of water and should be free from loading material or filler.

The following *upper limits* for the several constituents of different types of toilet soaps may also be quoted.[3]

	Free alkali NaOH.	Alkali as Na_2CO_3.	Free fatty acids as oleic acid.	Insoluble matter.	Water.	Actual soap.
	%	%	%	%	%	%
Floating Soap	0.25	0.40	0.50	1.0	20.0	80.0
Transparent Soap.	0.10	0.10	0.25	0.3	15.0	75.0
Castile Soap	0.25	0.25	0.50	1.0	10.0	85.0
Milled Soap	0.10	0.30	0.25	1.0	10.0	85.0

It would appear from the foregoing and other data that above 20 per cent. of water in any hard soap is rather excessive; that free alkali should be present in but very small amounts if present at all; that free fatty acids should not greatly exceed 0.5 per cent. although

[1]Dept. of Commerce, Bureau of Standards, Circ. 62, (1916).
[2]Canada Inland Revenue Dept., Bull. 408, 1918.
[3]No. Dakota Food Dept., Special Bull., IV, 2, (1916).

TABLE XIV.—ANALYSES OF

Station No.	Brand.	Manufacturer.	Weight of Cake.
	Laundry Soaps.		oz.
11959	Best	B. T. Babbitt	8.
12552	Bee	Colgate and Co	9.
11971	Sunny Monday	N. K. Fairbanks Co	7.
11960	Ozone	Fairchild & Sheldon Co	7.
11963	Naptha	Fels & Co	8.
11968	Borax	Kendall	8.
11961	Borax	Kirkham	10.
12551	Lenox	Proctor and Gamble Co	8.
12550	Star	Proctor and Gamble Co	9.
11972	White Naptha	Proctor and Gamble Co	9.
11962	Arrow Borax	Swift & Co	9.
12554	Pride	Swift & Co	8.
11970	U. S. Mail	Globe Soap Co	8.
12548	Welcome Borax		8.
	Toilet Soaps.		
13178	Miona Witch Hazel	Armour and Co	2.
13177	Venetian Verbena	Armour and Co	4.
13194	Castile	Cincinnati Soap Co	2.
13193	Monarch Oatmeal	Cincinnati Soap Co	2.
13192	Sternes Buttermilk	Cincinnati Soap Co	2.
13191	Sternes 47 Transparent Glycerine	Cincinnati Soap Co	2.
13188	Coleo	Colgate and Co	2.
13182	Palm	Colgate and Co	3.
13176	Lucerne Rose	Crystal Soap Co	3.
12555	Pearl	Globe Soap Co	4.
11969	White Rose	Globe Soap Co	3.
13206	Oatmeal	Holman Soap Co	4.
13207	Pure	Holman Soap Co	6.
13185	Violet Glycerine	Jergen	2.
13180	Glycerine	J. S. Kirk and Co	3.
13187	Jap Rose, Glycerine	J. S. Kirk and Co	3.
13189	Harmony Rose, Glycerine	Liggetts & Co	4.
13181	Rose Bath	Palmolive Co	2.
15263	Ivory	Proctor and Gamble Co	4.
13179	Oatmeal	John T. Stanley	1.
13184	Violet Spray Glycerine	Mm. Waltke & Co	4.
13190	Jersey Cream	J. B. Williams Co	3.
13186	Florentine Carnation	A. B. Wrisley Co	2.
12553	Lifebuoy	Lever Bros. Co	3.

SOAPS.

	Actual Soap in Cake.	Actual Soap Cost per Ounce.	Loss on Drying.		Fat and Unsaponifiable.	Free Fatty Acids as Oleic Acid.	Alkali, as Na_2O combined as		Fatty and Resin Anhydrides.	Actual Soap.	Insoluble in Alcohol and Water.
			at 100°C.	in vacuum at 20°C.			Carbonate, Silicate, etc.	Soap.			
	ozs.	cts.	%	%	%	%	%	%	%	%	%
59	5.1	1.4	25.56	....	4.27	0.42	2.30	7.70	54.71	62.41	2.26
52	5.6	1.4	27.94	....	1.89	none[1]	1.42	8.96	52.56	61.52	0.50
71	4.5	1.3	14.03	....	1.16	0.28	4.79	6.51	54.96	61.47	3.65
30	5.7	1.1	20.17	....	2.92	0.28	0.50	8.79	62.87	71.66	0.33
33	4.8	1.5	22.96	....	3.36	0.23	1.18	8.35	47.31	55.66	9.59
38	6.1	1.2	22.90	....	1.69	0.23	1.15	8.77	60.30	69.07	1.63
31	7.1	1.2	25.33	....	2.34	0.57	0.56	8.51	57.80	66.31	0.05
51	5.2	1.5	23.04	....	6.45	0.14	1.73	8.62	52.26	60.88	2.68
50	6.5	1.2	19.54	....	2.23	0.71	1.26	9.14	62.61	71.75	1.12
72	4.7	1.7	17.92	....	0.42	0.28	6.97	5.18	46.97	52.15	0.80
32	6.9	1.0	19.64	....	3.35	0.28	0.71	9.29	65.51	74.80	1.18
54	5.6	1.3	20.74	....	4.72	3.63	0.22	9.94	56.63	66.57	5.38
70	5.1	1.2	18.88	....	1.28	0.28	3.13	8.88	53.77	62.65	4.50
18	6.3	1.3	16.53	....	1.73	0.85	2.30	7.65	63.10	70.75	1.40
78	2.2	2.3	....	4.27	....	1.01	0.11	9.98	80.97	90.95	0.80
77	4.2	2.4	....	4.95	....	0.42	0.06	10.02	81.81	91.83	0.56
94	1.8	2.8	....	3.76	....	none[2]	0.20	9.45	72.97	82.42	10.80
93	1.9	2.6	....	5.66	....	none[2]	0.18	9.00	67.80	76.80	14.53
92	1.9	2.6	....	4.37	....	none[2]	0.17	9.32	74.48	83.80	8.28
91	1.3	3.9	11.21	6.70	....	0.67	0.06	7.87	56.29	64.16	0.12
38	2.7	3.7	4.55	4.25	....	0.56	0.10	10.52	83.42	93.94	0.48
32	3.2	3.1	4.63	4.63	....	none[2]	0.13	10.46	83.43	93.89	0.10
76	2.1	4.8	....	7.52	....	none[2]	0.72	7.15	54.29	61.44	0.20
55	3.9	1.5	8.39	....	0.46	0.42	0.47	10.71	72.44	83.15	1.45
39	3.0	1.7	6.60	....	0.65	0.23	0.16	10.92	73.42	84.34	1.20
96	4.1	2.4	....	5.51	....	0.45	0.30	10.08	79.70	89.78	1.44
97	5.5	1.8	....	3.58	....	none[2]	0.07	9.70	77.48	87.18	6.26
35	1.7	5.9	9.92	8.23	....	2.14	none	7.81	58.62	66.43	0.12
30	3.5	2.9	....	6.42	....	none[2]	0.10	10.30	80.94	91.24	0.80
37	2.5	4.0	10.16	7.37	....	none[2]	0.41	7.68	57.68	65.36	0.02
39	2.7	5.6	13.31	8.29	....	none[2]	0.26	7.68	57.62	65.30	0.08
31	2.4	2.1	....	5.65	....	none[2]	0.30	10.27	79.27	89.54	0.70
33	4.1	2.4	....	9.25	....	0.67	0.08	10.58	78.46	89.04	0.50
79	1.7	2.9	....	5.96	....	none[2]	0.11	10.11	80.19	90.30	4.72
34	2.6	3.8	....	8.09	....	none[2]	0.44	7.05	52.90	59.95	0.06
90	3.4	4.4	5.11	3.87	....	none[2]	0.24	10.39	83.07	93.46	0.18
36	2.6	3.8	5.02	4.76	....	0.45	0.10	10.27	81.43	91.70	1.18
53	3.3	3.0	10.25	....	1.18	0.56	0.12	8.38	76.63	85.01	0.05

ee alkali trace.
ee alkali none.

many specifications omit any reference to this item from which we might infer that it was not of serious consequence; that alkali combined in forms other than soap and free alkali, i.e., as carbonate, etc., is not undesirable and that the limits vary depending upon the purpose for which the soap is intended; that matter insoluble in water should not exceed about 1 per cent. (much less in toilet soap according to some specifications); and that resin is permissible[1] as a fatty substitute and its soap equally considerable with fatty soap as a detergent.

In interpreting the results summarized in Table XIV, several points should be kept in mind. As already explained loss on drying at 100°C. includes matter which is volatile at that temperature. Drying in vacuum at room temperature approaches more nearly the true water content although alkaline carbonates and silicates will still retain some moisture. Although unsaponified fat and unsaponifiable material have not been determined in all of the toilet soaps the amounts present will be small, generally not exceeding 1.0 per cent. Free alkali is regarded as free caustic alkali, a trace being found in only one sample. Alkali combined as carbonate, silicate, etc., is expressed, in some analyses, as sodium carbonate. We have expressed alkali in these forms as sodium oxide, but the figures can be interpreted as hydrated sodium carbonate by multiplying the figures as given in the table by two. In the case of toilet soaps the fatty and resin anhydrides include fat and unsaponifiable matter which were not separately determined, but the small amount of such material usually present will not substantially alter the figures given. The estimates of cost per ounce of actual soap are based upon the prices actually paid for samples at the time of purchase, but all of the laundry soaps and some of the toilet soaps were purchased in 1919 when the price of soap was abnormally high and somewhat higher than at present, although pre-war prices do not yet prevail.

The analyses indicate that free caustic alkali is not so generally present in soaps as many suppose. The liberation of free alkali by hydrolysis in solution is automatically corrected, to some extent at least, by the presence of free fatty acids which tend to neutralize it as formed. We understand that it is for this purpose that the practice of introducing an excess of fatty material ("superfatting") is adopted.

The losses sustained by the laundry soaps at 100°C. although above 20 per cent. in a number of samples cannot be said to be excessive since the loss is not entirely due to water. The toilet soaps have shown uniformly less than 10 per cent. of moisture.

The limits for free fatty acids judged by the specifications and standards cited are not conspicuously exceeded except in sample **12554.**

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[1]Lewkowitsch, II, p. 1073.

The actual soap, taken as the sum of fatty and resin anhydrides and alkali combined as soap, has been found to be between 60 and 70 per cent. as a rule in the case of laundry soap and generally above 80 per cent. in toilet soaps. Marked deficiencies in this respect in soaps of the latter type are due in part to glycerine and ingredients such as alcohol and sugar which enter into the composition of transparent soaps.

Insoluble matter in the laundry soaps is in most cases much higher than the specifications we have cited. This consists largely, or in part, of insoluble silica. Several of the toilet soaps show high percentages of insoluble matter due perhaps to siliceous matter added to increase detersive properties, or inert material such as starch, talc, etc. The cost of actual soap in products for laundry purposes is seen to vary between one cent and one and one-half cents per ounce, this upper limit being exceeded in only one case. The range is greater in the toilet soaps, the cost varying from one and one-half to about six cents per ounce. It will be noticed that no high-priced fancy soaps are included in the list.

Six miscellaneous samples of soaps have also been examined.

13943. *Cucumber Cream Soap*, made by U. S. Soap Co., New York, was found to contain 16.8 per cent. of water, 22.2 per cent. of fatty anhydrides and 3.4 per cent. of alkali (as Na_2O) combined as soap. It contained 25.6 per cent. of actual soap. Judging from the size of the wrapper the cake, as examined, was only about two-thirds of the original size indicating a large amount of water in the fresh soap.

15137, 15138, 15144. These soaps were examined for the Department of Entomology. They contained in the order named approximately 2.5 per cent., 4.19 per cent. and 35.6 per cent. actual soap.

14221, 14222. *Toilet Soaps.* Samples sent by the Department of Health, Bridgeport. They contained respectively 47.3 per cent. and 46.4 per cent. mineral matter insoluble in water.

TOILET PREPARATIONS.

The following samples were submitted by the Dairy and Food Commissioner.

16863. *Bay Rum.* Made by Wm. H. Loveland Co., Binghampton, N. Y., was declared to contain 20 per cent. of alcohol but was found to contain only 10.48 per cent. No. **16765** was passed. Neither contained wood alcohol.

17130. *Empress Instantaneous Hair Color Restorer*, Dark Brown shade and **17019**, the same name but a black shade. The Empress Manufacturing Co., Inc., New York.

Examination was as follows:

17130, bottle 1, contained paraphenylene diamine; bottle 2 contained 2.28 grams hydrogen dioxide per 100 cc. of solution.

17019, bottle 1, contained paraphenylene diamine and bottle 2 contained 1.16 grams hydrogen dioxide per 100 cc. of solution.

Paraphenylene diamine is a dangerous compound on account of its poisonous properties. Hair dyes, under other names, consisting of the same components as found in this one have been noted before[1].

The manufacturer claims that the danger attending the use of paraphenylene diamine is removed by the use therewith of an oxidizing agent such as hydrogen peroxide. However this may be, the evidence based upon reported injuries following the use of such preparations is that the combination does not work out satisfactorily in practice.

16939. *Liquid Silmerine.* Made by Parker, Belmont & Co., Chicago.

The sample was examined as follows:

Constituents are in grams per 100 cc. Solids 1.91; ash 1.26 (sodium carbonate and borate present); precipitable by alcohol 1.07 (uncorrected for ash).

16938. *Pepsodent.* Made by the Pepsodent Co., Chicago. Only alcohol was determined. It contained 1.52 per cent. alcohol by weight, no methyl alcohol present.

NOTE.

A request for a re-examination of our records in case of samples No. **14842**, Quinol Hair Tonic and No. **14872**, Lily of the Valley Toilet Water was received from the Colgate Company of New York. Examination of these preparations, Bulletin 219 of this Station, pp. 250 and 251, showed them to contain respectively 29.16 per cent. and 67.65 per cent. of alcohol by volume. The manufacturers claimed that careful control of these products was maintained and regularly showed 35 per cent. and 70 per cent. respectively. Our records show that duplicate determinations were made in case of **14842**, because of the variation, and that these were in close agreement; and no error was found in the record of sample **14872.** However, new samples of the preparations named were procured in the market by our Station agent and alcohol determined. Quinol Tonic was found to contain 34.85 per cent., and Lily of the Valley Toilet Water 68.56 per cent. of alcohol.

The Colgate Company was advised of our new results; but we are unable to find our original figures in error.

[1]Conn. Exp. Sta. Report 1914, p. 289; Report of Chem. Laby., Am. Med. Assoc., 1910, p. 111.

UNITED STATES PHARMACOPOEIA DRUGS.

Tincture of Cinchona and Tincture of Cinchona Compound.

The United State Pharmacopoeia prescribes that Tincture of nchona shall contain in 100 mils of solution not less than 0.8 am nor more than 1.0 gram of alkaloids of Cinchona; and that ncture of Cinchona Compound shall contain in a similar volume t less than 0.4 gram nor more than 0.5 gram of such alkaloids.

Seven samples of straight tincture and twenty-four of compound have been examined for the Dairy and Food Commissioner. The results are as follows:

BLE XV.—Assays of Tincture of Cinchona and Tincture of Cinchona Compound.

D. C. No.	Manufacturer or Dealer.	Alkaloids, gram. per 100 cc.
	Tincture of Cinchona.	
16950	*Bristol:* The Madden Drug Store	0.92
16752	*Danielson:* W. E. LaBelle	0.42
16923	*Hartford:* The Goodwin Drug Store	0.83
16598	*Norwich:* John A. Dunn	0.83
16582	*Putnam:* James F. Donahue	0.95
16862	*Waterbury:* Apothecaries Hall	0.78
16574	*Willimantic:* G. O. Cartier	0.61
	Tincture of Cinchona Compound.	
16851	*Bristol:* The Madden Drug Store	0.41
16703	*East Hartford:* W. B. Noble	0.54
16719	*Glastonbury:* The Peoples Pharmacy	0.36
16922	*Hartford:* The Goodwin Drug Co	0.49
16885	*Meriden:* N. P. Forcier	0.59
16758	*Mystic:* Edw. W. Gaskell	0.29
16771	*New London:* Dr. A. Crocicchia	0.35
16769	L. P. Desmarais	0.28
16762	James Drug Store	0.82
16600	*Norwich:* John A. Dunn	0.67
16593	Pitcher & Service	0.80
16586	*Putnam:* Ed. H. Burt	0.38
16583	James F. Donahue	0.46
15887	*Rockville:* Metcalfs'	0.51
15895	Thomas Pharmacy	0.57
16728	*South Manchester:* J. H. Quinn & Co	0.37
16723	T. Weldon & Co	0.45
16737	*Stafford Springs:* D. H. McCormick	0.37
15879	*Thompsonville:* Wm. J. O'Brien	0.33
16860	*Waterbury:* Apothecaries Hall	0.31
16868	H. W. Lake Drug Co	0.50
16575	*Willimantic:* G. O. Cartier	0.43
16886	*Winsted:* F. B. Bannon	0.42
16891	G. L. Fancher	0.48

In 12 cases the preparations are within the United States Pharacopoeia limits.

In 7 cases the variations are less than 10 per cent. of the standds; in 12 cases they exceed 10 per cent. Several preparations

would be satisfactory if correctly labeled. For example, No. **16752** is low for a straight tincture, but is within the limits for a compound, while Nos. **16593** and **16762** are too high for compounds, but would pass for straight tinctures. As they stand however, they must be classed as adulterated.

Solution of Hydrogen Dioxide.

The United States Pharmacopoeia requires that this preparation shall contain not less than 3 per cent. by weight of hydrogen dioxide (H_2O_2).

Among other specifications are the following:

Not more than 0.03 gram of solid residue remains on evaporating 20 mils of solution to dryness; and not more than 2 mils of N/10 potassium hydroxide are required to neutralize 25 mils of the solution.

Results of our analyses of twenty-three samples are as follows:

Table XVI.—Assays of Hydrogen Dioxide.

D. C. No.	Brand.	Hydrogen dioxide. %	Solids, gm. per 20 cc.	Acidity, cc N/10 KOH per 25 cc. solution.
16595	A. D. S.	3.62	0.021	1.80
16877	Albany Chemical Co.	3.07	0.024	2.50
16705	Brewer & Co.	3.29	0.015	1.88
16754	Brewer & Co.	3.04	0.015	2.25
16883	Brewer & Co.	3.03	0.057	5.00
16772	Butler Bros.	3.02	0.022	1.38
16893	Earle & Co.	3.07	0.016	1.65
15885	Eastern Drug Co.	3.07	0.026	1.25
16770	Eimer and Amend.	3.18	0.024	1.88
16920	Goodwin's Drug Store.	3.08	0.018	2.88
16590	Mallinckrodt Chemical Works.	2.88	0.037	1.38
15897	Mallinckrodt Chemical Works.	3.05	0.024	0.63
16711	Mallinckrodt Chemical Works.	3.00	0.033	1.38
16724	Mallinckrodt Chemical Works.	3.05	0.023	0.75
16596	Merck & Co.	2.95	0.030	1.38
16866	National Peroxide Co.	3.15	0.024	1.63
16579	Oakland Chemical Co.	3.74	0.008	0.65
16571	Parke, Davis Co.	3.08	0.017	1.85
16716	Parke, Davis Co.	3.16	0.024	2.13
16735	Parke, Davis Co.	3.11	0.025	2.25
16852	Parke, Davis Co.	3.20	0.025	1.63
15869	Powers-Wightman-Rosengarten Co.	3.09	0.023	1.38
16751	Powers-Wightman-Rosengarten Co.	3.01	0.029	2.38

All of the samples meet the requirement as to actual hydrogen dioxide or come within reasonable limits thereof, or of the declared strength; but several show excess of solids or of acidity or both. Since it has been found that the exact manipulation of the Pharmacopoeia method for acidity gives uncertain results in some

cases, a modified procedure[1] has been followed in case of samples showing high acidity.

Samples **16920, 16877, 16751, 16735,** and **16754** are in excess of the Pharmacopoeia specifications for acidity by more than 10 per cent.; **16590** is in excess in solids; and **16883** is greatly in excess both as regards acidity and solids.

Lime Water.

The United State Pharmacopoeia requires that this solution shall contain not less than 0.14 per cent. of calcium hydroxide when prepared at 25°C.

The percentage of calcium hydroxide varies somewhat with the temperature at which the solution is prepared being about 0.17 per cent. at 15°C. and diminishing as the temperature rises.

Thirty-two samples were examined for the Dairy and Food Commissioner of which twenty-five met the requirements and seven were deficient. The deficient samples ranged from 31.4 per cent. to 81.0 per cent. of standard strength.

The results are as follows:

Table XVII.—Assays of Lime Water.

D. C. No.	Manufacturer or Dealer.	Calcium hydroxide, per cent.
16942	*Bristol:* Perry N. Holley	0.173
16949	The Madden Drug Store	0.150
16753	*Danielson:* W. E. LaBelle	0.146
16704	*East Hartford:* W. B. Noble	0.101
16712	O'Connell Drug Co.	0.159
16717	*Glastonbury:* The People's Pharmacy	0.145
16919	*Hartford:* The Goodwin Drug Co.	0.106
16756	*Jewett City:* Charles R. Carey	0.179
16876	*Meriden:* W. W. Mosher	0.178
16881	Charles H. Pinks	0.167
16884	N. P. Forcier	0.054
16937	*Middletown:* John J. Cronin	0.178
16760	*Mystic:* Edward Gaskell	0.190
16853	*New Britain:* Crowell's Drug Store	0.176
16767	*New London:* J. Burro	0.185
16592	*Norwich:* P. F. Bray	0.114
16597	George M. Rathborn	0.179
16585	*Putnam:* James F. Donahue	0.142
16589	E. H. Burt	0.179
15886	*Rockville:* Metcalf's	0.077
15896	Thomas Pharmacy	0.044
16730	*South Manchester:* J. H. Quinn & Co.	0.155
16738	*Stafford Springs:* D. H. McCormick	0.169
16743	Ethel H. Wickes	0.170
15872	*Thompsonville:* George R. Steele, Est.	0.179
15878	William J. O'Brien	0.165
16858	*Waterbury:* Apothecaries Hall	0.058
16870	H. W. Lake Drug Co.	0.169
16572	*Willimantic:* G. O. Cartier	0.163
16577	Charles DeVilliers	0.161
16890	*Winsted:* G. L. Fancher	0.174
16894	John A. Williams	0.165

[1] [illegible]

Solution of Magnesium Citrate.

One hundred mils of this solution contains magnesium citrate corresponding to not less than 1.5 grams of magnesium oxide.

There is no direct numerical standard for citric acid, but according to the formula as given by the Pharmacopoeia one hundred mils should contain 9.4 grams of this ingredient.

Of the twelve samples examined for the Dairy and Food Commissioner only one failed to meet the required or declared strength as regards magnesium oxide. The following summary shows the results of assays compared with the requirements of the standard or special declarations.

Sample No. **16924** was assumed to be of standard strength, there being no declaration to the contrary, but it was found to be only 60 per cent. of standard. In cases where special declarations of quality or strength were made they were found to be substantially correct. The deficiencies in total citric acid may possibly arise from a part of the magnesium being derived from magnesium sulphate.

Table XVIII.—Assays of Solution of Magnesium Citrate.

D. C. No.	Manufacturer or Dealer.	Magnesium oxide, gms. per 100 cc. Required.	Magnesium oxide, gms. per 100 cc. Found.	Free acid, as citric, gms. per 100 cc.	Total citric acid, gms. per 100 cc. Required.	Total citric acid, gms. per 100 cc. Found.
16710	*East Hartford:* O'Connell Drug Co.	1.5	2.11	3.85	9.4	10.4
16924	*Hartford:* The Goodwin Drug Co.	1.5	0.90	1.87	9.4	5.7
16761	*Mystic:* Edward W. Gaskell	1.5	1.71	3.29	9.4	9.9
16857	*New Britain:* Crowell's Drug Store	1.5	1.69	2.91	9.4	9.3
16773	*New London:* Dr. A. Crocicchia	1.5	2.06	1.21	9.4	8.7
16594	*Norwich:* Pitcher & Service	0.9	0.94	1.70	5.6	5.4
16588	*Putnam:* E. H. Burt	1.3	1.26	0.62	5.4	5.3
15888	*Rockville:* Metcalf's	1.5	1.42	2.55	9.4	7.4
16736	*Stafford Springs:* D. H. McCormick	1.5	1.62	2.32	9.4	8.0
15871	*Thompsonville:* George R. Steele, Est	1.5	1.52	4.03	9.4	7.9
16859	*Waterbury:* Apothecaries Hall	0.8	0.87	2.48	...	6.0
16576	*Willimantic:* Charles DeVilliers	0.8	0.77	1.28	...	3.9

Tincture of Nux Vomica.

The United States Pharmacopoeia requires this preparation to contain not less than 0.237 gm. nor more than 0.263 gm. of the alkaloids of nux vomica.

Twenty-five samples were submitted by the Dairy and Food Commissioner for examination. Only three were found to be within the prescribed limits of 0.237 to 0.263. Ten others, however, varied from these limits by less than 10 per cent. while six more were but slightly in excess of 10 per cent. variation. Of the

remaining six samples four were deficient, ranging from 0.160 gm. to 0.182 gm. per 100 cc., one was considerably over strength and one was not reported as there was not sufficient material to check the original assay which showed a deficiency.

The results are as follows:

TABLE XIX.—ASSAYS OF TINCTURE OF NUX VOMICA.

D. C. No.	Manufacturer or Dealer.	Alkaloids of Nux Vomica gm. per 100 cc.
16948	*Bristol:* The Madden Drug Store	0.160
16702	*East Hartford:* W. B. Noble	0.200
16713	O'Connell Drug Co	0.232
16718	*Glastonbury:* The Peoples Pharmacy	0.226
16918	*Hartford:* The Goodwin Drug Co.	0.262
16755	*Jewett City:* Charles R. Carey	0.226
16759	*Mystic:* Edward W. Gaskell	0.211
16763	*New London:* J. H. James	0.440
16766	J. Burros	0.298
16768	E. Callahan	0.269
16591	*Norwich:* P. F. Bray	0.182
16599	John A. Dunn	0.204
16581	*Putnam:* J. J. Dupre	0.255
16584	James F. Donahue	0.160
16587	E. H. Burt	0.182
15889	*Rockville:* F. E. Metcalf	0.218
15894	Thomas Pharmacy	0.306
16729	*South Manchester:* J. H. Quinn & Co	0.226
15870	*Thompsonville:* George R. Steele, Est	0.226
16861	*Waterbury:* Apothecaries Hall	0.204
16869	H. W. Lake Drug Co	0.255
16573	*Willimantic:* G. O. Cartier	0.218
16578	Charles DeVilliers	0.226
16895	*Winsted:* John A. Williams	——
16887	F. B. Bannon	0.264

SATURATED SOLUTION OF POTASSIUM IODIDE.

A prescription calling for a saturated solution of potassium iodide was presented by an Inspector of the Dairy and Food Commissioner's office at five different drug stores in four different cities in this state. Solutions ranging from 63.5 per cent. to 99.5 per cent. of saturation were obtained, judging saturation by the solubility of the salt at 20°C. The amount of salt in a saturated solution varies with the temperature at which the solution is made. Thus a solution saturated at 25°C. should contain 59.7 per cent. of the salt; if saturated at 0°C. only 56.0 per cent. would be present. The usual range in temperature of "cold water" used in official formulas is taken to be 15° to 25°[1] and we therefore chose the mean of these, or ordinary room temperature, saturated at which a solution should contain 59.0 per cent. of potassium iodide[2].

The results of the assays are given in Table XX.

[1]U. S. P. IX, p. XLIX.

[2]Seidell, (1907) p. 252.

TABLE XX.—ASSAYS OF "SATURATED" SOLUTION OF POTASSIUM IODIDE.

D. C. No.	Druggist.	Potassium iodide in solution, per cent.	Degree of saturation, per cent.
15787	*Bridgeport:* Julius Ginsbert......	58.74	99.5
18401	*Hartford:* Kaufman's Pharmacy..	42.42	71.9
15786	*New Haven:* A. Harowitch......	37.45	63.5
15850	*Norwich:* D. T. Salesser.........	50.91	86.3
15851	Smith Pharmacy............	54.93	93.1

These results are surprising when one considers that a saturated solution of the salt is very easy to prepare, and that specific information as to its solubility is given in the Pharmacopoeia. Yet three of the solutions show varying degrees of carelessness in preparation.

HAMAMELIS (WITCH HAZEL) WATER.

Among other specifications in the United States Pharmacopoeia this preparation contains not less than 14 per cent. of alcohol, by volume and should not respond to tests for methyl alcohol.

Eleven samples have been examined for the Dairy and Food Commissioner and determinations of alcohol and tests for methyl (wood) alcohol made. No wood alcohol was found in any case and in only one, No. **15863**, was substantially less than the required or declared amount of alcohol found.

The results are as follows:

TABLE XXI.—INSPECTION OF HAMAMELIS (WITCH HAZEL) WATER.

D. C. No.	Manufacturer or Dealer.	Alcohol by volume per cent.	Methyl alcohol.
16757	J. R. Carey, Jewett City.........	14.04	none.
15863	Childs, New York...............	7.88	none.
16580	Charles DeVilliers, Willimantic...	14.20	none.
15875	E. E. Dickenson, Essex..........	14.00	none.
15893	E. E. Dickenson, Essex..........	14.60	none.
16706	E. E. Dickenson, Essex..........	14.28	none.
16725	E. E. Dickenson, Essex..........	14.40	none.
16943	E. E. Dickenson, Essex..........	14.20	none.
16915	Goodwin's Drug Store, Hartford..	14.04	none.
16865	Salem Chemical and Supply Co., Salem, Mass.................	14.36	none.
16739	The Sisson Drug Co., Hartford...	14.48	none.

MISCELLANEOUS DRUGS, ETC.

Twenty-four samples of miscellaneous materials have been submitted chiefly by health officials and physicians. Two of these were unofficial samples from the Dairy and Food Commissioner's office.

D. C. No. **17042**. *Furniture Polish.* The preparation was found to be a mixture of cottonseed oil and denatured alcohol in the

approximate proportions of 90 parts of oil and 10 parts of alcohol.

D. C. No. **15788.** *Essence of Peppermint.* It contained 82.20 per cent. of alcohol, by volume. No methyl alcohol was detected.

14442 and **14395.** *Turpentine.* Neither sample was found adulterated.

14442. Specific gravity at 15.6°C. 0.8851; color white, yellowish; polymerization residue 0.7 per cent.

14395. Specific gravity at 15.6°C. 0.8774; color white; polymerization residue 0.7 per cent.

14406. *Tablets* submitted by a physician for identification were found to contain morphine.

14457. *Pills* submitted by a physician were found to contain codeine.

14622. *Pills* submitted by a physician were found to contain 46.2 per cent. of sodium bicarbonate and 46.1 per cent. of milk sugar. No other medicament was found.

14631. *Tablets* submitted by a physician. These were hypodermic tablets of morphine sulphate, 1/4 grain, and atropine sulphate 1/150 grain. We were requested to determine the variation in gross weights and in weights of medicament.

Twenty-five tablets examined. Minimum weight 0.0244, maximum 0.0274, average 0.0257 gram.

Two groups of three tablets each assayed. Total alkaloid found (1) 0.0160 and (2) 0.0150 gram as morphine sulphate per tablet or 0.246 and 0.230 grain per tablet as compared with 0.256 grain total alkaloid declared.

The tablets were satisfactory both as regards variation in weight and medicament.

14805. *White tablets* submitted for identification. They were found to be morphine hydrochloride.

15336 and **15337.** *Liniment.* Samples submitted by New Haven County Health Officer.

Examinations: **15336.** Reaction alkaline; solids 13.40 grams per 100 cc.; ash 5.58; arsenic (As.) 2.53; vegetable extractives present, unidentified; alcohol none.

15337. Reaction acid; solids 1.98 grams per 100 cc.; ash 0.45; gallic or gallotannic acids indicated.

The first preparation is a water solution containing a relatively large amount of arsenic as the most conspicuous ingredient. The second sample was also a water solution consisting of, or containing, gallic or gallotannic acids or both.

14697, 14698, 14699. *Unknown Drugs,* submitted by the City Health Department, Bridgeport. Two samples were boric acid and the third was potassium permanganate.

15066. *Medicine,* submitted by the County Health Officer, Bridgeport. The sample was greyish white in color, with a salty taste but not bitter. It was found to consist of 98.3 per cent.

bicarbonate of soda and 1.7 per cent. of material insoluble in dilute acid largely or entirely vegetable material, unidentified, but resembling cardamon.

15104. *Medicine,* with prescription submitted by the County Health Officer of Bridgeport. The prescription proved to be too complicated to detect or determine all of the eight ingredients. So far as we could discover, however, there was no evidence that the preparation was not of the substance and quality demanded.

14287. *Saccharin tablets,* were found to consist of saccharin and milk sugar.

15338. *Hair Dye* said to be Canute Water but not submitted in original container.

The amount of material was only 10cc. but it was found to be an alkaline solution of silver nitrate.

14049, 14681. *Arsenate of Lead.* The first was submitted by Dr. Britton, State and Station Entomologist, the second by Mr. Fay, County Agent for Middlesex County.

Analyses:	14049	14681
	%	%
Moisture	0.40	.....
Lead (PbO)	65.72	64.13
Arsenic (As_2O_5)	29.18	32.66

15182. *Hexpo,* Smith's, Insecticide and Fungicide.
Analysis in parts per 100:

Moisture 5.65; silica 0.80; sulphuric acid (SO_3) 20.84; copper (metallic) 16.62; lead (PbO) 17.70; arsenic (As_2O_5) 8.10.

The mixture consists of about two-thirds copper sulphate and one-fourth lead arsenate.

15090. *Lime Sulphur Solution.* The specific gravity at 20°C. of the solution was 1.3073 equivalent to 34.1 Baumé. This is somewhat above the average density (24° to 25°).

13647. *Linseed Oil.* The sample was found to contain lead and mineral oils.

15038. *A Veterinary Preparation* said to be Stark's Reducine was found to consist essentially of a fatty base with iodides and tar.

MOTOR GASOLINE.

Gasoline generally signifies a product of crude petroleum produced by the process of distillation. This is called straight refinery gasoline. Newer types are the so-called casing-head gasoline, produced from natural gas by compression or other processes, and "cracked" or synthetic gasoline produced from heavy oils of the kerosene type by the "cracking" process. Both of these products are important factors in the present motor fuel supply but neither is generally sold as such but in the form of blends.

Gasoline is not a definite chemical substance like water or alcohol but a mixture of hydrocarbon compounds in varying proportions. The most essential characteristic of gasoline is its property of rapid vaporization which is shown and measured by determining the distillation range of the fluid. It should not contain too large a proportion of low boiling constituents, a condition which results in undue loss and danger in handling and in storage. These light fractions are the most expensive constituents in gasoline and it is therefor desirable from the standpoint of economy to include as large a proportion of the heavier and higher boiling constituents as the vaporizing power of the engine will permit. The motor derives its power from the heat of combustion of fuel. This is measured in terms of British thermal units (so-called B.T.U's.) and varies within rather narrow limits for the different varieties of gasoline. For this reason the calorific power is not generally determined in routine tests. Specific gravity alone, expressed in Baumé degrees, and generally referred to as the "test," has no significance, as an index to the substance and quality of gasoline.

Chapter 166 of the Public Acts of 1919 relates to the sale of adulterated or inferior products as gasoline. The term "gasoline" as used in the Act is construed to mean "only gasoline which has not been adulterated and with which there has been made no addition, combination or mixture of any other article after it has passed from the ownership of the manufacturer." No standards or specifications are defined in the Act.

Arrangement was made with the Commissioner of Motor Vehicles to test samples of gasoline in this laboratory, but no official samples have been received. Anticipating such work, a few preliminary tests were made of the common market brands. The apparatus and methods used were as described and recommended in Technical Paper 214, Bureau of Mines; and the specifications for distillation range those adopted by the Committee on Standardization of Petroleum Specifications effective November 25th, 1919.[1]

These specifications are as follows:

(a) Initial boiling point not higher than 60°C. (140°F.); (b) 20 per cent. of sample must distill below 105°C. (221°F.); (c) 50 per cent. must distill below 140°C. (284°F.); (d) 90 per cent. must distill below 190°C. (374°F.); (e) end or dry point must not exceed 225°C. (437°F.); (f) not less than 95 per cent. will be recovered in the receiver from the distillation.

The actual *distillation loss* is the difference between the original volume taken (100cc.) and the sum of the volumes of the distillate and of the residue left in the distillation flask.

Data obtained on 15 samples examined are summarized in Table XXII.

[1]. Oil and Gas Jour. **18**, 26, 62 1919. Chem. Absts., **14**, 3, 342 1920.

TABLE XXII.—EXAMINATION OF MOTOR GASOLINE.

No.	Date 1920.	Brand.	Color.	Sp. Grav. degrees Baumé 15.6°C.	Acidity, cc N/10 alkali per 100 cc gasoline.	Distillation range, degrees. Initial b.p., first drop.	20% distilled at or below.	50% distilled at or below.	90% distilled at or below.
Standards or Limits.			**Water white**	....	**none**	**60**	**105**	**140**	**190**
13200	3/17	Atlantic	white	61.0	none	35	89	130	187
13948	8/25	Atlantic	white-yel'sh	60.5	none	41	86	127	184
13195	3/17	....	white	58.4	none	45	96	116	160
13949	8/25	....	white-yel'sh	57.2	none	47	100	135	189
13197	3/17	Goodrich	white	60.7	none	40	91	125	185
13946	8/25	Goodrich	white	59.2	none	47	96	137	189
13199	3/17	Gulf	white	60.0	none	40	87	116	182
13951	8/26	Gulf	white	61.8	none	42	92	122	177
13945	8/25	Gulf	white	60.5	none	44	90	119	181
13950	8/25	Socony	white	57.3	none	39	96	135	189
13198	3/17	Standard	white	59.7	none	42	100	128	180
13196	3/17	Texas	white	57.9	0.1	48	99	130	188
13947	8/25	Texas	white	57.9	none	44	95	131	187
13201	3/17	Tydol	white	59.2	none	44	98	128	177
13959	8/25	Tydol	white	62.3	none	51	93	123	183

We are not prepared to discuss these results in terms of t relative desirability or efficiency of the several brands of gasoli represented. Efficiency of fuel utilization depends upon seve or many factors other than the quality of the fuel itself. Pra cally all the samples meet the specifications and standards have selected in all respects. No. **13946** is seen to exceed the e temperature by 5 degrees and the distillation residue in case **13196** was slightly acid. It would appear, however, that of t gasolines with the differences shown between **13200** and **139** for example, one might be better adopted to a particular con tion or purpose than the other. The first shows a larger proporti of the lighter and low boiling fractions together with about limit of heavy constituents, while the second contains neitl extreme. It would also appear that each product sampled two different seasons of the year shows a reasonably satisfact degree of uniformity of composition.

SUMMARY.

Materials.	Sampled by, or at request of: Station Agent.	Sampled by, or at request of: Dairy and Food Commissioner.	Sampled by, or at request of: Individuals.	Total.	Adulterated, below standard or otherwise illegal.
Foods.					
Carbonated Soft Drinks	9	189	0	198	63
Cereal Products:					
Breakfast foods	2	0	0	2	0
Health foods	0	0	3	3	0
Flour	0	4	4	8	2
Cider	0	2	4	6	0
Cocoa	0	1	3	4	0
Coffee	15	2	1	18	0
Desiccated Foods	8	0	0	8	0
Diabetic Foods	120*	0	7	127	....
Egg and Egg Products	10	0	27	37	0
Fats and Oils:					
Olive oil	0	2	3	5	0
Cooking fats	1	2	0	3	0
Butter	0	22	1	23	4
Oleomargarine	0	5	0	5	0
Nut margarine	2	0	0	2	0
Gelatin, etc	0	8	0	8	3
Ice Cream	0	400	4	404	48
Milk and Milk Products:					
Market milk	0	1,056	102	1,158	329
Cream	0	6	4	10	0
Imitation milk	3	0	0	3	0
Milk powder	4	0	0	4	0
Malted milk	4	0	2	6	0
Human milk	0	0	14	14	0
Syrup	0	0	2	2	0
Tea	7	0	0	7	....
Vinegar	0	1	9	10	3
Miscellaneous Materials:					
Foods, etc	5	0	8	13	....
Liquors	0	10	81	91	6
Other materials	0	7	38	45	....
Total	**190**	**1,717**	**317**	**2,224**	**395**
Drugs.					
Proprietary Remedies	5	0	0	5	....
Soap	38	0	6	44	2
Toilet Preparations	2	6	0	8	3
U. S. P. Drugs:					
Cinchona, Tincture of	0	7	0	7	2
Cinchona Compound, Tincture of	0	24	0	24	10
Hydrogen Dioxide	0	23	0	23	7
Lime Water	0	32	0	32	7
Magnesium Citrate, Solution of	0	12	0	12	1
Nux Vomica, Tincture of	0	25	0	25	11
Potassium Iodide, Saturated Solution	0	5	0	5	3
Witch Hazel Water	0	11	0	11	1
Miscellaneous Drugs, etc	0	2	22	24	....
Gasoline	15	0	0	15	....

CONNECTICUT

Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 228 **MARCH, 1921**

Connecticut Round Tip Tobacco

A New Type of Wrapper Leaf

By D. F. JONES

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the editions permit.

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Vegetable Growing. ————————

Press of The Wilson H. Lee Company.

Connecticut Round Tip Tobacco.

A New Type of Wrapper Leaf for Priming; Recommended for Trial Where Havana is Grown.

By D. F. Jones.

Both Havana and Broadleaf tobaccos grown in New England have rather narrow-pointed leaves so that the yield of wrappers from a pound of leaf is relatively small. In an endeavor to obtain a type having a more nearly round leaf which would equal or prove better than the two well-known varieties in quality and surpass them in yield, a new variety of tobacco has been developed by ten years of selection and testing. This variety is called Connecticut Round Tip on account of the broad, full tips of the leaves and is offered to tobacco growers in the belief that it has *certain distinct advantages which make it worthy of serious consideration.*

In recommending a new type of tobacco for trial it is fully realized that there are many reasons why any variety differing from those commonly grown may be undesirable for the grower, no matter how meritorious it is, because the trade is unfamiliar with it and there is therefore a tendency to discriminate against it. At the same time no one can maintain that the kinds of tobacco now used will always be grown or that it is impossible to obtain new varieties which will be more profitable than those now employed.

Connecticut Round Tip should not be confused with other new varieties offered from time to time, most of which were variable hybrids which had not been fixed and stabilized nor had they been selected so extensively or carefully as this tobacco has been for certain definite qualities. No plants of Connecticut Round Tip were grown outside of our trial grounds previous to 1918. But in the last three years it has been tested in the field of comparison with types now grown and has been shown to have certain valuable qualities which merit attention.

Origin of the Round Tip Tobacco.

The problem was to combine in one variety or type the higher number and the better shape of leaves of Sumatra with the larger size and other desirable qualities of Broadleaf.

The method of doing this had been developed by previous study of inheritance in tobacco.

An artificial cross was first made between Sumatra and Broadleaf. The seed was planted the next year and from the resulting plants seed was saved for the third year's planting, when the selections were begun.

Each plant was carefully studied and noted as to all important characters which could be observed in the fields. From the plants which represented the desired size and shape, seed was saved under bags for the next year's test while all the less desirable plants were dropped out. This process was repeated year after year for ten successive years till finally three selections remained which seemed equally promising. Then these were tested on a larger scale.

In 1916 about one-third of an acre of each was grown, and separately harvested, cured and sorted and the weights and proportions of the different grades were used in making the final choice.

Throughout the work selection has been based largely on the weights and appearances of the cured and sorted leaves.

It is not a "hybrid" as the term is usually understood. A hybrid is a natural or artificial cross of two fairly settled varieties and the individual hybrid plants the second and immediately following years are very variable. Years of very careful selection are required to secure a variety or type with fixed characters.

The Round Tip here described comes from a "hybrid" which has been carefully protected from natural crossing and selected for ten years so that its uniformity to type is fully equal to that of either of the varieties commonly grown in the state.

This new tobacco is largely the result of the work of E. M. East, formerly with this station and now at the Bussey Institute of Harvard University. H. K. Hayes, also formerly connected with this station, and E. G. Beinhart of the U. S. Department of Agriculture, have had a large part in producing Connecticut Round Tip. The writer has continued and completed the work. B. G. Southwick of the Hartford County Farm Bureau has rendered valuable help in securing the co-operation of growers in carrying out field tests of the variety and in interesting dealers in the merits of the leaf. During the first years of development the tobacco selections were grown for the Connecticut Experiment Station by the Windsor Tobacco Corporation at Bloomfield. Later they were grown at the Shaker Farms at Somers. Much credit is due J. B. Stewart and M. M. Smith for their co-operation in this enterprise.

Characteristic Features of Round Tip Tobacco.

The plant is a tall, vigorous grower which flowers and sets seed abundantly in the field. It has a strong root system which enables the plants to stand up in the field better than Havana. The leaves are not as large as Broadleaf but they are more com-

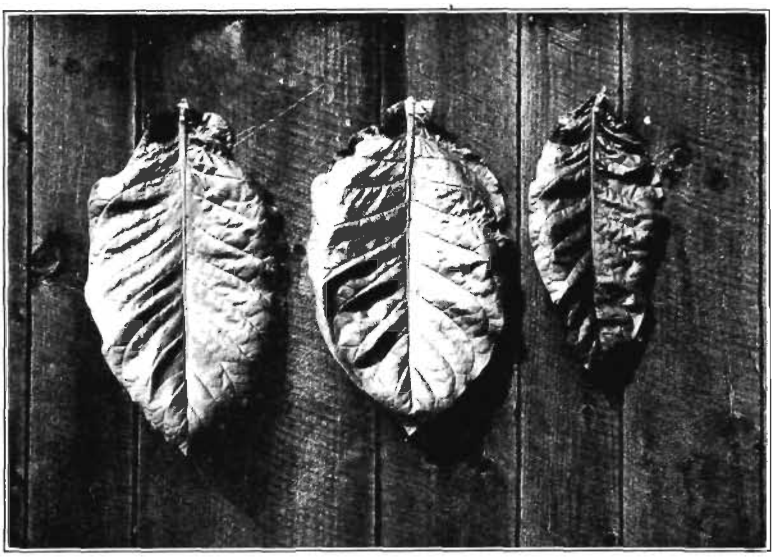

Figure 1. Round Tip leaves from the bottom, middle and top of one plant at the time of first priming.

Figure 2. A field of Round Tip grown by Morgan & Dickinson, Windsor, Conn., in 1920, who say: "It showed wonderful growth, averaging 24 leaves to the stalk, and we were particularly impressed with the round shape of the leaves and the plant's root system."

Figure 3. Round Tip plants grown by T. J. Kearney, Poquonock, Conn., in 1920, who was pleased with their vigorous growth and production of numerous and well shaped leaves.

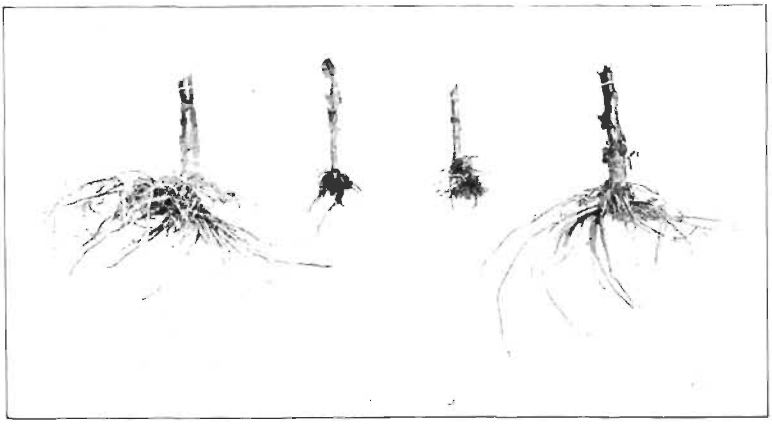

Figure 4. Roots of two plants of Round Tip, at the sides, compared with two roots of Havana, in the center, arranged in the order and comparative distance in which they grew in a field badly infested with root rot.

part, having a broad rounding shape without the long drooping tip usually shown by that variety. The plants develop from twenty to twenty-four good sized leaves per plant. These are spaced somewhat farther apart on the stalk than those of either Broadleaf or Havana, making the plants more suitable for priming than for stalk cutting. By topping lower with from sixteen to eighteen leaves the cut tobacco can be handled satisfactorily in the sheds.

In one field in 1919 a few plants were accidently set among Havana in the field which was badly infected with root rot. The Havana plants made a very small growth while the Round Tip plants showed no sign of injury to the roots. They were vigorous and fully twice as tall as the Havana plants growing beside them. The differences in root growth are shown in the accompanying illustration. If this resistance to unfavorable soil conditions proves to be characteristic of this variety under all conditions it will be a most valuable feature and one which alone makes the variety very promising.

At their best the leaves are nearly as wide as they are long and are noticeably full at the tip. They are also held upright and close to the stalks, thus avoiding considerable damage in the field. The lengths of the leaves run from sixteen to twenty-six inches but on account of their shape a twenty inch leaf is equivalent to a much longer leaf of either Havana or Broadleaf and pound for pound yields a greater number of wrappers.

In color and quality of cured leaves the tobacco is more nearly like Havana and is recommended for the uses to which Havana is put. Many have said that it resembles shade grown Cuban somewhat. However, in color and general wrapper qualities it is usually distinct from any of the varieties now grown and in time should win a place for itself on its own merits.

Field Tests.

In testing the productiveness and quality of this tobacco it has been difficult to get a satisfactory trial for the reason that it has not been grown in sufficient amount. It has not been possible to devote much seed bed space to the growing plants and consequently there have never been enough plants to set the field all at one time. As a result, plants differing in maturity were harvested at the same time as it was necessary to pick the whole field at each priming. Moreover, the plants were handled as Havana was treated and it has since been learned that the Round Tip requires somewhat different treatment in certain particulars.

It is generally agreed that the leaves should be picked earlier than the Havana leaves of the same stage of development. They should not be left until they show yellow. The plants being large

yielders are heavy feeders and must be fertilized accordingly. Producing more leaves than Havana it should be fed proportionately more. This extra expense is fully justified since on a given area and with the same labor, except for handling, a greater quantity of tobacco is produced. The leaves being wider than Havana they should be spaced farther apart in the sheds in order to cure properly.

In 1915 at Bloomfield 1400 pounds per acre were secured and the year following 1800 pounds in three primings not counting tops. In 1918 at the Shaker Farms the rate of 2800 pounds per acre was obtained from a field of about one-third of an acre. In 1919 it was tested in seven different places in the valley by growers of Havana in amounts ranging from one-fourth to five acres. Three of them grew it as a stalk tobacco and the others primed it. The weights ran from 1400 to 1600 pounds per acre. The tobacco was set rather late and on account of uneven planting the conditions were not favorable to this variety.

In 1920 Round Tip was grown in thirteen different places in amounts from a few plants to eight acres. The tobacco made a good growth in spite of a late start in many cases, until damaged by the hail storm. In spite of much injury to the last pickings weights of from 1600 to 2000 pounds per acre were secured. The percentage of light wrappers was also high in nearly every case.

When properly cured the "burn" is satisfactory. The only serious objection to this tobacco is that it may have a bitter taste. Some think that this can be obviated by proper curing and ageing.

Its remarkable ability to stand up on soils in which other tobacco fails to thrive was also shown very clearly in 1920 in those places where a direct comparison could be made.

Opinions of Tobacco Growers.

From M. M. Smith, The Shaker Farms, Somers, Conn.

The young plants of the new variety of tobacco started more quickly, grew a large round tip leaf, required very little suckering, and stood up against a storm better than the ordinary type. As the yield of leaves and weight was more than the type usually grown, believe it should be fed accordingly. Also found that owing to wide spreading of roots, there is danger of too deep cultivation after plant is half matured.

From Morgan & Dickinson, Windsor, Conn.

We set out 9,000 plants of Round Tip on June 27th, 1920, and finished harvesting our tops on Sept. 14th. The 9,000 plants produced 1,778 pounds with some loss in weight by hail, as the last ten leaves were cut in the storm. This tobacco produced 828 pounds of No. 1 Wrappers and 571 pounds of No. 2 Wrappers. It showed wonderful growth, averaging 24 leaves to the stalk, and we were particularly impressed with the round shape of the leaves and the plant's wonderful root system. After assorting and handling this tobacco we bulked same and turned the bulks six times allowing the temperature to reach 116 degrees. After turning the sixth time we baled and placed in a warm room. We have no fault to

find with our experiment but on the other hand are very much pleased with it as far as we have gone. We had a local manufacturer use a little of it and the yield is good. He said he could wrap 1,200 cigars with two pounds.

From A. H. Brown, Windsor Tobacco Growers, Inc., Windsor, Conn.

My experience with the Round Tip Tobacco the season of 1919 and 1920, while in the nature of an experiment only so far as the growing and curing is concerned, has convinced me that it possesses many desirable qualities from the grower's standpoint. It seems to produce good results on what is called "sick land" owing perhaps to its stronger root growth, and is less affected by wind storms. The name Round Tip well describes the shape of the leaves and the lower fifteen vary but little in length. In 1919 I harvested from twenty-two to twenty-six leaves per stalk but in 1920 a hail storm destroyed the leaves on the upper part of the stalk after harvesting fifteen but the number was the same as in the previous season. From my experience would advise priming a little earlier than we do the Havana variety at least the lower part of the plant. In regard to the "appearance of the assorted and fermented leaves" the failure of a number of expert tobacco men to select a Sumatra wrapped cigar placed in a box with cigars wrapped with Round Tip is pretty good evidence that it possesses the qualities that the trade demands. While its taste has been adversely criticised many smokers have grave doubts as to their ability to detect it in any way.

From Benjamin L. Haas, L. B. Haas & Co., Hartford, Conn.

Our experience has been that this new type of tobacco requires a greater length of time to cure properly. There are features of this tobacco which necessitate the tobacco being in bulk a greater length of time, and it should lay in the bale, at least, two or three months before being manufactured. There are qualities in the Connecticut Round Tip which must eventually prove to be very profitable to the cigar manufacturers. We are of the opinion that this type of tobacco will become very popular after we understand how to handle it. It requires more time in curing process than any other type of tobacco we are now growing.

From W. A. Haviland, The Haviland Tobacco Co., East Windsor Hill, Conn.

We grew one-half acre of Round Tip on land that had ceased to give us a satisfactory growth of "shade." On one side of this we grew Conn. Havana and on the other a Wisconsin resistant Havana No. 2901. This No. 2901 did very well, in fact much better than the Conn. Havana but the Round Tip throughout the entire season was larger and thriftier than either. Our experience leads us to believe that the Round Tip will yield well, even on "sick soils"; the shape of the leaf is good, the third priming is comparatively better than that of primed Havana and if a certain bitterness can be overcome in sweating Round Tip should be a very valuable tobacco.

From The Farnham Tobacco Corp., Hartford, Conn.

The seed of Round Tip tobacco which I used was rather poor and the general impression I had of the plants was that they were much slower in growing than either the Havana Seed or the Broadleaf. They seemed to be harder to push to the size necessary for planting. I planted the tobacco closely, about eleven thousand plants to the acre, and found the same tendency in regard to growth applied to the early-set plants as well as those which were in the beds, but when the tobacco became eight or ten inches high it grew rapidly and from that time on until maturity it grew faster than any other variety I had. The time for harvesting the

first leaves, in my judgment, is when the tobacco reaches the height of a man's shoulder, as I found when picking was delayed it became thick and of very poor color. Just before the tobacco buds out I found it ready to harvest up as high as the fourteenth leaf, and have decided next year to have all the good tobacco off, up to the eighteenth leaf by the time the plants break into flower. I found this tobacco more or less difficult to cure, the leaves having a tendency to stick together, due to the gum which the tobacco carries to a marked degree. The shape of the leaf is all that can be desired both as to length and width. Probably it would suit a larger number of customers if it did not grow as long as it does, but am perfectly satisfied in that regard. The only criticism I have to make is regarding the taste, which of course is a very important one, but I firmly believe that as time goes on it will be taken care of without trouble. The tobacco has a bitter taste, and although extreme temperatures have been tried in the fermentation, it has not been eliminated as yet. I believe that if the tobacco was taken down in very high case and put directly into the bulk and allowed to reach a very high temperature this trouble would be remedied. If this one factor can be taken care of and the tobacco made one which will appeal to the taste of the average smoker, I believe that it is by far the best thing that the Valley has ever had and should really make a new era in tobacco growing.

Conclusion.

It has not been our policy to say much about this tobacco as we expect it to win its own way. If it has real merit, as the preliminary trials show, it will be grown in so far as it proves profitable. In order to be appreciated it must be seen growing in the field and after sorting. Before the manufacturers will buy this tobacco they must appreciate what it is and know that it can be secured in quantity. The fact that a large number of cigars can be wrapped per pound of leaves is one forceful reason why they should give this new tobacco a careful trial.

This brief history and description is written to introduce the Connecticut Round Tip to the tobacco growers of this district in the belief that when it is tested on an adequate scale and becomes familiar to the buyer that it will be profitable for growers and manufacturers alike.

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 229 MARCH, 1921

BEING THE

Report on Commercial Feeding Stuffs

1920

By E. M. BAILEY

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The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the editions permit.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

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March, 1921.

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Press of The Wilson H. Lee Company.

Commercial Feeding Stuffs.

By E. M. Bailey.*

PROVISIONS OF THE STATUTES RELATING TO FEEDING STUFFS.

Under the Connecticut statutes the term "concentrated commercial feeding stuffs" covers practically all feeds excepting hay and straw, whole seed, unmixed meal made directly from any of the cereals or from buckwheat, and feed ground from whole grain and sold directly from manufacturer to consumer.

Under the new fertilizer law cottonseed meal is classed as a commercial fertilizer and, as such, is subject to analysis fees and tonnage tax. Provision is made, however, to exempt meal sold exclusively for feeding purposes.[1]

Section 4775 requires that every lot or parcel of concentrated commercial feeding stuff shall bear a statement giving the name and address of the manufacturer or importer, the number of net pounds in the package, the name of the article, and the percentage of protein and fat contained in it. The law forbids the use of any metal in affixing tags.

No registration of feed or payment of analysis or license fees is required.

The penalty for violation of the statute is not more than $100 fine for the first offense and not more than $200 for each subsequent offense.

The law authorizes this Station to take samples from any manufacturer or dealer, in a prescribed manner, and requires the Station to analyze annually at least one sample of each brand which it has collected, and to publish these analyses "together with such additional information in relation to the character, composition and use thereof as may be of importance."

CLASSIFICATION OF SAMPLES.

The classification and summary of commercial feeding stuffs and other materials requiring fodder analysis which have been examined during the past year is as follows:

---

*Analyses are by Messrs. Shepard, Nolan and Merwin.

[1]Chap. 204, Public Acts, 1919.

Official samples taken by the Station Agent	141
Submitted by the Dairy Commissioner and by individuals	56
Examined in connection with field experiments at Storrs	362
Examined in connection with field experiments of this Station	44
Total	603

This report is concerned only with the results of the official inspection and with samples submitted by the Dairy Commissioner and by individuals.

Official samples taken by the Station Agent are classified as follows:

Cottonseed Meal	16	Maize Products	19
Cottonseed Feed	2	Distillers' Grains	1
Linseed Meal	2	Dried Beet Pulp	3
Wheat Bran	10	Cocoanut Meal	1
Wheat Mixed Feed	5	Peanut Oil Cake	1
Wheat Middlings	16	Proprietary Stock Feeds	53
Rye Products	2	Poultry Feeds	9
Oat Feed	1		
		Total	141

ETHER EXTRACT IN MOLASSES FEEDS.

In 1913 Street[1] called attention to the fact that in case of feeds containing molasses, the regular ether extraction method generally failed to remove all of the ether-soluble substances. By first washing out saccharine materials with water, drying and then extracting with ether higher results for "fat" were usually obtained. Since that time this modified proceedure for the determination of fat has been followed in such samples as were known, or declared, to contain molasses.

A summary of the results for the period 1913 to 1919 inclusive is as follows:

Year	Ether Extract by Modified Method. Higher than regular.	Ether Extract by Modified Method. Lower than regular.	Total number of samples.
1913	17	5	22
1914	7	12	19
1915	18	3	21
1916	11	20	31
1917	6	2	8
1918	0	6	6
1919	11	3	14
Totals	70	51	121

It appears that out of 121 cases, 51, or about 42 per cent., gave lower figures for ether extract by the modified method than by the regular proceedure. Nevertheless it would appear to be a more rational practice to wash out sugars before proceeding to extract

[1]Conn. Exp Sta. Report 1913, Part V p. 313 et seq.

with ether and the results, even when lower, are probably nearer the truth so far as true fat is concerned. But since the term fat in a guaranty means crude fat (i. e. ether extract) it has been customary to report the higher figure for this ingredient by whichever method obtained.

Of the nine samples of molasses feeds examined this year eight equaled their guaranties for fat by the regular method and they were not subjected to the modified treatment. The one sample falling below guaranty and which was checked by the modified method gave a higher result by that proceedure.

COEFFICIENTS OF DIGESTIBILITY AND NET ENERGY VALUES.

The significance of digestion coefficients and net energy values of feeding stuffs has been briefly discussed in previous bulletins.[1] These factors for most of the types of feeds reported herein are given in the following table:

TABLE I.—COEFFICIENTS OF DIGESTIBILITY AND NET ENERGY VALUES OF FEEDING STUFFS.[2]

Feed	Average dry matter, lbs. per hundred.	Coefficient of digestibility.				Net energy value, Therms per hundred lbs.
		Protein	Fiber.	Carbohydrates.	Fat.	
Cottonseed Meal	92.2	84	37	75	95	90.0
Cottonseed Feed	....	58	45	61	90	....
Linseed Meal (old process)	90.0	89	57	78	89	88.9
Linseed Meal (new process)	90.4	86	73	87	95	85.1
Wheat Bran	89.9	76	43	74	62	53.0
Wheat Feed	....	77	36	76	87	...
Wheat Middlings	89.6	77	30	78	88	59.1
Red Dog Flour	....	88	36	88	86	....
Rye Flour	....	80	..	88	90	...
Barley, ground	90.7	88	70	93	86	89.9
Barley Bran	....	85	20	86	87	....
Corn Gluten Meal	90.9	85	55	90	93	84.2
Corn Gluten Feed	91.3	85	76	88	85	80.7
Hominy Feed	89.9	66	76	90	91	81.3
Brewers' Grains	92.5	81	49	57	89	53.4
Malt Sprouts	92.4	77	87	80	85	72.7
Distillers' Grains, Corn	93.4	73	95	81	95	85.1
Distillers' Grains, Rye	92.8	59	..	67	84	56.0
Beet Pulp, dried	91.8	52	83	83	..	75.9
Peanut Cake, without shells	89.3	90	9	84	90	93.6
Soybean Meal, fat extracted	88.2	92	99	100	68	99.7
Cocoanut Cake	90.4	90	23	87	100	83.5

[1]Conn. Exp. Sta. Bull. 212 p. 357, 1918; Bull. 221 pp. 347-351, 1919.

[2]Henry and Morrison, 15th ed., pp. 118-119; Armsby and Putney, Penn. Exp. Sta., Bull. 142, 1916.

INSPECTION OF 1920.

Remarks on Analyses.

(*Analyses on pages* 306-323)

The definitions of the various feeding stuffs here given are those adopted by the Association of Feed Control Officials of the United States and revised to 1920.

Definitions of the several grades of cottonseed meal are as follows:

Cottonseed Meal is a product of the cottonseed only, composed principally of the kernel with such portion of the hull as is necessary in the manufacture of oil, provided that nothing shall be recognized as cottonseed meal that does not conform to the foregoing definition and that does not contain at least 36 per cent. of protein.

Choice Cottonseed Meal must be finely ground, not necessarily bolted, perfectly sound and sweet in odor, yellow, free from excess of lint, and must contain at least 41 per cent. of protein.

Prime Cottonseed Meal must be finely ground, not necessarily bolted, of sweet odor, reasonably bright in color, yellow, not brown or reddish, free from excess of lint, and must contain at least 38.6 per cent. of protein.

Good Cottonseed Meal must be finely ground, not necessarily bolted, of sweet odor, reasonably bright in color, and must contain at least 36 per cent. of protein.

Revision of these definitions is contemplated and tentative definitions[1] are as follows:

41.12 *Per cent. Protein Cottonseed Meal, Choice Quality*, must be finely ground, not necessarily bolted, perfectly sound and sweet in odor, yellow, free from excess of lint, and by analysis must contain at least 41.12 per cent. crude protein, equivalent to 8 per cent. of ammonia.

Cotton seed meal not fulfilling the above requirements as to color, odor, or texture, shall be branded Off Quality.

38.56 *Per cent. Protein Cottonseed Meal, Prime Quality*, must be finely ground, not necessarily bolted, of sweet odor, reasonably bright in color, yellow, not brown or reddish, free from excess of lint, and by analysis must contain at least 38.56 per cent. crude protein, equivalent to 7.5 per cent. of ammonia.

Cottonseed meal not fulfilling the above requirements as to color odor or texture, shall be branded Off Quality.

36 *Per cent. Protein Cottonseed Meal, Good Quality*, must be finely ground, not necessarily bolted, of sweet odor, reasonably bright in color, and by analysis must contain at least 36 per cent. crude protein equivalent to 7 per cent. of ammonia.

Cottonseed meal not fulfilling the above requirements as to color, odor or texture shall be branded Off Quality.

Readjustment of prices is particularly conspicuous in this product. The prices given in Table IV were those which prevailed at the time these samples were taken (November and December 1920); the prevailing price at this time (March 1st, 1921) is less than $50 per ton.

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[1]Adopted at the annual meeting of the A. F. C. O., November, 1920.

Of the sixteen samples examined three showed a deficiency in protein of more than 1 per cent. None were deficient in fat. Fiber content is not required to be stated under the law in this State but, if given, it should be correct; three samples exceeded the maximum limit for this ingredient by more than 1 per cent. in each case. The average protein content, 39.4 per cent., is substantially higher than the average found for several years past.

Cottonseed Feed is a mixture of cottonseed meal and cottonseed hulls, containing less than 36 per cent. of protein.

Two samples were analyzed one of which was slightly below guaranty in both protein and fat.

Linseed Meal is the ground product obtained after extraction of part of the oil from ground flaxseed and cleaned of weed seeds and other foreign materials by the most improved commercial processes, provided that the final product shall not contain over six per cent. of weed seeds and other foreign materials and provided further that no portion of the stated six per cent. of weed seeds and other foreign materials shall be deliberately added.

The two samples examined conformed to their guaranties.

Wheat Bran is the coarse outer coating of the wheat kernel as separated from cleaned and scoured wheat in the usual process of commercial milling.

All of the samples examined conformed to their guaranties with respect to protein and fat. One sample, **15652**, showed an excess of fiber.

Wheat Mixed Feed consists of pure wheat bran and the gray or total shorts or flour middlings combined in the proportions obtained in the usual process of commercial millings.

All of the samples examined conformed to their guaranties.

Standard Middlings (*Red Shorts or Brown Shorts*) consists mostly of the fine particles of bran, germ and very little of the fibrous offal obtained from the "tail of the mill." This product must be obtained in the usual commercial process of milling.

Gray Shorts (*Gray Middlings or Total Shorts*) consists of the fine particles of the outer bran, the inner or "bee-wing"bran, the germ, and the offal or fibrous material contained from the "tail of the mill." This product must be obtained in the usual process of commercial milling.

White Shorts or White Middlings consists of a small portion of the fine bran particles and the germ and a large portion of the fibrous offal obtained from the "tail of the mill". This product must be obtained in the usual process of flour milling.

All of the samples examined conformed to their guaranties with the exception of **15640** which was deficient in both protein and fat.

Rye Middlings or Rye Feed consists of the products other than the flour obtained in the manufacture of the ordinary "100 per cent." rye flour from the rye grain which has been cleaned and scoured.

The two samples examined conformed to their guaranties for both protein and fat.

Oat Products. Only one sample of oat feed was analyzed and this satisfied the requirements of the guaranty.

Corn Gluten Feed is that portion of commercial shelled corn after the separation of the larger part of the starch and the germ by the processes employed in the manufacture of cornstarch and glucose. It may or may not contain corn solubles.

All of the samples examined were found to meet their guaranties In one case, however, no guaranty was given.

Corn Meal. Only one sample was analyzed for which there was no statement of guaranty.

Hominy Feed is the kiln dried mixture of the mill run bran coating, the mill run germ, with or without a partial extraction of the oil and a part of the starchy portion of the white corn kernel obtained in the manufacture of hominy, hominy grits and corn meal by the degerminating process.

The only deficiency found was in **15608** which was 0.95 per cent. below guaranty in fat.

Distillers' Products. Only one sample of distillers' dried grains was examined. It was of normal composition and quality.

Dried Beet Pulp is the material obtained by drying the residue from sugar beets which have been cleaned and freed from crowns, leaves and sand and which have been extracted in the process of manufacturing sugar

The three samples examined conformed to their guaranties for protein and fat and no excess of fiber greater than 1 per cent. was found.

Cocoanut Oil Meal (*"Copra Oil Meal"*) is the ground residue from the extraction of part of the oil from the dried meat of the cocoanut.

The single sample examined contained 0.94 per cent. less than the guaranteed amount of protein.

Peanut Oil Meal is the ground residue after the extraction of part of the oil from peanut kernels.

The single sample examined was deficient in protein by 2.06 per cent.

Proprietary Mixed Feeds. When compounded with materials of good quality these feeds possess undoubted merit. The variety of sources from which they derive their nutrients makes possible a supplementing of nutritive elements which modern ideas of efficient feeding endorse as a rational practice. They should not be made an outlet, however, for refuse or low-grade materials of little worth.

The law in this State does not require a statement of the ingredients of which such feeds are composed but information is valuable to the feeder and it is furnished in case of the following brands:

Acorn Dairy Feed. Cottonseed meal, linseed meal, wheat bran with mill run screenings, corn gluten feed, ivory nut meal, cocoanut meal, corn feed meal, starch mill corn solubles with calcium salts, salt, kafir meal.

Algrane Milk Feed. Cotton seed meal, linseed oil meal, corn gluten feed, ground corn, wheat midds (with mill run screenings) ground barley, molasses, salt ½ of 1 per cent., oat hulls, oat shorts, oat clippings not over 600 lbs. per ton.

Biles Ready Dairy Ration. Corn distillers' dried grains, choice cottonseed meal, old process linseed meal, white wheat middlings, winter wheat bran, hominy meal, cocoanut oil meal, corn gluten feed, brewers' dried grains, barley malt sprouts, one-half per cent. fine table salt, and nothing else.

Bull Brand Stock Feed. Hominy feed, corn feed meal, barley feed, linseed oil meal, wheat bran, wheat middlings, second clear flour clipped oat by-product and three-fourths of one per cent. salt (wheat bran and wheat middlings may contain ground screenings not exceeding mill run).

Crosby's Stock Food. Ground barley, ground hominy feed, ground oats, oat feed (oat hulls, oat shorts, oat middlings).

Fourex Dairy Ration. Cottonseed meal, old process linseed meal, hominy meal, wheat bran and middlings, gluten feed, reground oat feed (oat hulls, oat shorts, oat middlings). Rye middlings, malt sprouts and salt.

Hamlin's Quality Feed. Corn, oats, alfalfa and cane syrup.

National Dairy Feed. Ground corn, ground oats, wheat bran, screenings from bran, oats, wheat and barley, cottonseed meal, copra meal, alfalfa meal, molasses, one per cent. salt.

Portage Stock Feed. Either white or yellow shelled corn, barley, oat shorts, oat hulls, oat middlings, wheat middlings, and ½ of one per cent. salt.

Purina Cow Chow. Linseed oil meal (old process), gluten feed from corn, hominy feed, cottonseed meal, ground alfalfa, molasses and one per cent. salt.

Purina Pig Chow. Hominy feed, cane molasses, gluten feed from corn, corn meal, digester tankage, linseed oil meal (old process), alfalfa, charcoal (made from humus) and one per cent. salt.

Red Star Dairy Feed. Gluten feed, wheat bran, wheat middlings, old process oil meal, ground barley, cottonseed meal, corn distillers' grains, hominy and 1% salt.

Syragold Milk Ration. Dried brewers' grains, malt sprouts, corn gluten feed, linseed meal, wheat bran with mill run screenings, cottonseed meal, ground cottonseed hulls and salt.

Ti-O-Ga Dairy Feed. Cottonseed meal, old process linseed meal, wheat bran, cane molasses, wheat middlings, cocoanut oil meal, dried brewers' grains, corn gluten meal, corn gluten feed, barley, salt.

H-O Company's Laying Mash. Linseed oil meal, corn gluten feed, bone meal, ground corn, oat middlings, wheat middlings and wheat bran (with mill run screenings), hominy feed, rolled oats, ground peas.

SUMMARY OF DEFICIENCIES.

Variations from guaranty greater than 1 per cent. in protein and crude fiber and 0.25 per cent. in fat together with other remarks or criticisms are summarized in Table II.

TABLE II.—FEEDS NOT CONFORMING TO GUARANTIES OR OTHERWISE ILL

Station No.	Brand and Manufacturer.	Protein deficiency.	Fat deficiency.	Fiber excess.	Remar'
	Cottonseed Meal.				
15601	Crown. Ashcraft-Wilkinson Co., Atlanta, Ga.	% 1.37	%	% 1.21	
15606	Paramount. Ashcraft-Wilkinson Co., Atlanta, Ga.	....	....	....	Wire tags
15635	Jay. F. W. Brode & Co., Memphis, Tenn.	....	....	....	Wire tags
15628	Prime. Cotton Seed Products Co., Louisville, Ky.	....	....	....	Wire tags
15564	Good. W. D. Hall Co., Atlanta, Ga.	....	....	....	Wire tags
15548	Memphis. L. B. Lovitt & Co., Memphis, Tenn.	....	....	1.12	Wire tags
15540	Danish. Humphreys-Godwin Co., Memphis, Tenn.	1.44	....	....	
15631	Thirty Six. L. B. Lovitt & Co., Memphis, Tenn.	....	....	....	Wire tags
15532	Holstein. Steele-Kolb By-Products Co., Inc., Birming am, Ala.	2.50	....	3.20	
	Cottonseed Feed.				
15523	77. Humphreys-Godwin Co., Memphis, Tenn.	....	0.37	....	Wire tags
	Wheat Bran.				
15620	The Anthony Mills, Anthony, Kansas.	....	....	....	Wire tags
15652	The Hunter Milling Co., Wellington, Kansas.	....	....	....	Wire tags
15522	Maple Leaf Milling Co., Limited, Toronto, Canada.	....	....	....	Wire tags
	Wheat Middlings.				
15640	Shorts. James Goldie Co., Guelph, Ont.	1.25	1.38	...	
	Corn Gluten Feed.				
15561	Hubinger Bros. Co., Keokuk, Iowa‡.	....	....	....	No guara
	Corn Meal.				
15664	Unknown.	....	....	....	No guara
	Hominy Feed.				
15559	Aunt Jemima Mills Co., St. Joseph, Mo.	....	....	....	Wire tags
15570	The Patent Cereal Co., Geneva, N. Y.	....	....	....	Wire tags
15608	Plymouth's Pure. Plymouth Milling Co., Lemars, Iowa.	0.95	....	....	
	Peanut Oil Meal.				
15657	Beta. Oil Seeds Co., Bayonne, N. J.	2.06	....	....	
	Proprietary Feeds.				
15653	Stock Feed. Hales & Edwards, Chicago‡.	....	0.83	....	
15531	Vitality Stock Feed. Rosenbaum Bros., Chicago.	1.69	....	....	

‡Statement of dealer.

LE II.—FEEDS NOT CONFORMING TO GUARANTIES OR OTHERWISE ILLEGAL—*Concluded.*

	Brand and Manufacturer.	Protein deficiency.	Fat deficiency.	Fiber excess.	Remarks.
3	Acorn Dairy Feed. Chapin & Co., Hammond, Ind.	%	%	%	Wire tags, illega
9	Crosby's Quality Feed Dairy Ration. E. Crosby & Co., Brattleboro, Vt.	1.12	....	....	
9	Eshelman's 20 Dairy Feed. John W. Eshelman & Sons, Lancaster, Pa.	2.44	....	....	
5	Syragold Milk Ration. Syracuse Milling Co., Syracuse, N. Y.	....	....	2.74	
7	Unknown	....	....	....	No guaranty.
5	Pioneer Hog Feed. Hales & Edwards, Chicago	....	0.68	....	

MISCELLANEOUS SAMPLES, ETC.

CAROB BEANS.

Three analyses of carob beans, otherwise known as locust beans and St. John's bread are here given. Sample **15974** was obtained through the courtesy of Meech & Stoddard, Inc., Middletown, who also submitted a sample of bean and pod meal, No. **15833**. The third analysis is taken from the literature[1]. Analyses are of the bean and pod.

ANALYSES OF CAROB BEANS.

Sample No.	15974 %	15833 %	Quoted analysis. %
Moisture	13.29	6.09	15.00
Ash	2.57	16.97	2.50
Protein	4.67	5.19	5.90
Fiber	5.91	6.67	} 75.30
Nitrogen-free Extract	73.12	62.76	
Fat	0.44	2.32	1.30

The high ash content in **15833** is due to a large amount (12.72 per cent.) of sand from dirt adhering to the beans.

CRUDE FIBER.

A sample of feed sent out by Mr. G. L. Bidwell, of the Bureau of Chemistry, Washington, Referee on methods for crude fiber determination, was examined in this laboratory by Mr. Shepard. His result, by the method proposed, was 13.35 per cent. By the proccedure employed here he obtained 13.07 per cent.

[1]Farmer's Bulletin 121, p. 17, 1900.

Samples Submitted by the Dairy Commissioner.

Three samples have been examined.

18528. *Chick feed,* was found to consist largely of cracked corn, oats, rye, millet and screenings. No decomposed or injurious material was detected.

17501 R and **11376 J.** *Interstate samples of Cottonseed meal* by Inspector W. J. Warner to check a sample, **13864,** drawn by our Station Agent. They contained respectively, 5.77 per cent. and 5.82 per cent. of nitrogen. Our original sample, **13864,** contained about 1 per cent. less nitrogen, five determinations on two separate sub-samples giving results of 4.92, 4.84, 4.91, 4.78 and 4.78 per cent. The various samples were taken from what was said to be the same shipment but there were evidently two different grades of meal in the lot. The goods were sold under a guarty of 5.76 per cent. nitrogen, equivalent to 36 per cent. protein.

Samples Submitted by Individuals.

Corn Products. **14404.** Sweet corn, sent by F. C. Hubbard, Middletown, contained 10.4 per cent. of moisture.

14472. Farmers' Gluten, sent by The Coles Co., Middletown, contained 30.63 per cent. of protein.

15813. Gluten Feed, sent by A. S. Tanner, New Preston, contained 24.88 per cent. of protein.

14426. Gluten Feed, sent by H. R. Stone, Southbury, was analyzed as follows:

Moisture 6.30; ash 2.79; protein 25.19; fiber 6.52; nitrogen free extract 55.84; fat 3.36. per cent.

14889. Hominy, sent by Middlefield Grain and Coal Co., Middlefield, contained 11.13 per cent. of protein.

14430. Hominy, sent by Powder Hill Dairy Farm, Wallingford, contained 11.75 per cent. of protein.

14428. Hominy, sent by A. Gerosia, Plainfield, contained 8.85 per cent. of crude fat.

16194. Hominy Feed, sent by the Yantic Grain and Products Co., Norwich, contained 10.50 per cent. of protein and 4.15 per cent. of fiber.

Wheat Products. **15840.** Flour Middlings, sent by M. Asher, Andover, contained 17 per cent. of protein.

14755. Treated Bran, sent by Meech & Stoddard, Inc., Middletown. It consisted of coarse bran, probably wheat, with a small proportion of charred material, evidently the result of toasting or scorching.

15354. Shredded Wheat Waste for poultry, sent by Z. N. Beach, Wallingford, contained 12 per cent. of protein.

Proprietary Mixed Feeds. Fifteen samples have been submitted.

16077. Horse Feed, sent by L. A. Bevan, County Agent, Danbury.

15459. Cow Feed, sent by Miss A. P. Bingham, Rockfall.

15972. Dairy Feed; and **15973.** Dry Mash, both sent by L. B. Merriman, Torrington.

15978 and **15979.** Special Mixtures, sent by L. H. Healey, North Woodstock.

16115. Horse Feed, sent by American Sumatra Tobacco Co., East Hartford.

15329. College Stock Feed, sent by H. R. Stone, Southbury. Guaranty, protein 10 per cent.; fiber 11 per cent.; fat 2.5 per cent.; carbohydrates 60 per cent.

15447. Rabbit Mule Feed; **15448.** Green Cross Mule Feed; and **15932.** Monogram Feed, all sent by the Griffin Tobacco Co., Bloomfield.

15411. Big Repeater Dairy Ration, sent by E. H. Rollins, Granby.

15255. Farmer Jones Dairy Feed, sent by Washington Supply Co., Inc., Washington Depot.

14414. Eshelman's 24, sent by L. W. Smith, New Preston.

16054. Dairy Feed, sent by Charles T. Mason, Washington Depot.

The analyses of these feeds are given in the following Table:

TABLE III.—ANALYSES OF PROPRIETARY FEEDS SUBMITTED BY INDIVIDUALS.

Station No.	Moisture. %	Ash. %	Protein. %	Fiber. %	Nitrogen-free Extract. %	Fat. %
16077	6.16	8.79	20.38	6.16	52.97	5.54
15459	10.22	5.85	25.00	8.03	45.69	5.21
15972	7.87	4.21	19.19	9.55	53.61	5.57
15973	7.77	9.10	20.88	7.09	47.98	7.18
15978	7.17	3.86	20.44	8.50	55.05	4.98
15979	7.19	3.95	20.94	7.84	55.99	4.09
16115	7.29	6.97	11.25	13.82	58.59	2.08
15329	10.59	....	13.19	6.99	.....	5.75
15447	8.60	7.32	10.63	14.84	56.83	1.78
15448	8.78	5.05	11.06	11.14	60.82	3.15
15932	6.77	7.21	12.94	10.76	59.88	2.44
15411	10.19	....	24.50	9.96	.....	5.44
15255	.....	....	22.44	.....	.....	....
14414	.....	....	24.88	.....	.....	....
16054	8.28	....	25.44	.....	.....	9.21

Unclassified. **15880.** Alfalfa Feed, damaged, sent by Arthur Mather, Hartford, was found to contain a normal amount (10.13 per cent.) of protein and otherwise not obviously inferior.

15812. Cottonseed Feed, sent by A. S. Tanner, New Preston, contained 35.13 per cent. of protein.

16124. Sample sent by C. E. Slauson Co., Stamford, for identification. The material had the composition and general appearance of dried beet pulp.

14352 and **14336.** Yeast Grains, sent by T. C. Dyer, Collinsville, contained respectively 23.52 per cent. and 21.06 per cent. of nitrogen.

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand.	Retail Dealer.
	OIL SEED PRODUCTS.	
	Cottonseed Meal.	
15601	Crown. Ashcraft-Wilkinson Co., Atlanta, Ga.	*Torrington:* D. L. T Guaranty..........
15584	Helmet. Ashcraft-Wilkinson Co., Atlanta, Ga.	*New Milford:* Geo. E. Guaranty..........
15606†	Paramount. Ashcraft-Wilkinson Co., Atlanta, Ga.	*Winsted:* E. Manche Sons.......... Guaranty..........
15635†	Jay. F. W. Brode & Co., Memphis, Tenn....	*South Coventry:* W. (mer.......... Guaranty..........
15628†	Prime. The Cotton Seed Products Co., Louisville, Ky.	*Granby:* E. H. Rollin Guaranty..........
15580	Ordinary. Ennis Cotton Oil & Manufacturing Co., Ennis, Tex.	*New Milford:* Geo. T Guaranty..........
15581	Choice. Fidelity Products Co., Houston, Texas.	*New Milford:* Geo. T Guaranty..........
15564†	Good. W. D. Hall Company, Atlanta, Ga....	*Wallingford:* A. E. H Guaranty..........
15586	Bull. Humphreys-Godwin Co., Memphis, Tenn.	*Danbury:* H. E. Meel Guaranty..........
15540	Danish. Humphreys-Godwin Co., Memphis, Tenn.	*West Chesire:* G. W. T Guaranty..........
15666	Danish. Humphreys-Godwin Co., Memphis, Tenn.	*New Haven:* R. G. D Sons.......... Guaranty..........
15548†	Memphis. L. B. Lovitt & Co., Memphis, Tenn.	*Plainville:* Eaton Bro Guaranty..........
15631†	Thirty Six. L. B. Lovitt & Co., Memphis, Tenn.	*Hartford:* Meech Gra Guaranty..........
15532	Holstein. Steele-Kolb By-Products Co., Inc., Birmingham, Ala.	*Hamden:* I. W. Beers Guaranty..........
15654	Planet. A. C. Westervelt & Co., Memphis, Tenn.	*Middletown:* Meech & dard, Inc.......... Guaranty..........
15598	Winder Oil Mill Co., Winder, Ga..........	*Waterbury:* Spencer Co.......... Guaranty.......... Average guaranty... Average of analyses.. Average digestible...
	Cottonseed Feed.	
15555	Danish. Humphreys-Godwin Co., Memphis, Tenn.	*Branford:* S. V. Osbo Guaranty..........
15523†	77. Humphreys-Godwin Co., Memphis, Tenn.	*East Haven:* F. A. Fc Guaranty.......... Average guaranty... Average of analyses. Average digestible...

†Wire tags.

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Pounds per Hundred.						Price per ton.
Water.	Ash.	Protein. (N.x6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat)	
6.66	6.50	37.25	11.21	31.51	6.87	$70.00
.....	.....	38.62	10.00	23.00	6.00	.....
6.54	7.53	40.38	7.35	29.24	8.96	60.00
.....	.....	41.00	10.00	23.00	6.00	.....
6.82	6.07	36.19	11.62	32.28	7.02	65.00
.....	.....	36.00	14.00	27.00	5.50	....
7.71	5.03	35.44	13.86	31.57	6.39	58.00
.....	.....	36.00	14.00	30.00	5.00	....
8.98	6.02	39.69	10.36	28.21	6.74	52.00
.....	.....	38.62	10.00	.. ..	6.00	.....
6.80	6.63	46.88	4.77	24.39	10.53	60.00
.....	.....	43.00	12.00	25.00	6.00	.....
6.74	6.73	46.50	4.35	24.62	11.06	60.00
.....	.....	43.00	12.00	.....	6.00	.....
8.11	6.36	36.00	11.83	31.84	5.86	47.00
.....	.....	36.00	14.00	27.00	5.50	.....
6.97	5.83	44.13	7.17	28.16	7.74	62.00
.....	.....	43.00	10.00	26.00	5.00	. ..
7.92	5.92	34.56	12.88	31.95	6.77	58.00
.....	.....	36.00	15.00	25.00	5.00	.....
8.42	6.26	36.50	11.78	29.98	7.06	.....
.....	.....	36.00	15.00	25.00	5.00	.....
8.65	6.45	38.06	13.12	27.21	6.51	70.00
.....	.....	38.50	12.00	27.50	5.50	.....
7.26	6.69	39.38	10.92	27.56	8.19	67.00
.....	.....	36.00	14.00	28.50	5.00	.....
7.62	5.88	33.50	17.20	29.01	6.79	64.00
.....	.....	36.00	14.00	27.00	5.00	.....
11.21	7.32	44.31	6.64	22.24	8.28	62.00
.....	....	43.00	10.00	26.00	6.00	.....
6.27	6.99	41.75	6.81	28.28	9.90	58.00
.....	.....	38.50	7.10	30.75	7.50	.....
.....	.....	38.70	12.07	26.48	5.62	.....
7.67	6.39	39.41	10.12	28.62	7.70	60.86
.....	.....	33.10	3.74	21.47	7.40	.....
8.28	6.35	36.06	11.24	30.56	7.51	64.00
.....	.....	36.00	15.00	25.00	5.00	.....
8.58	3.79	19.63	26.53	37.84	3.63	55.00
.....	.....	20.00	28.00	35.00	4.00	.....
.....	.....	28.00	21.50	32.50	4.50	.....
8.43	5.07	27.85	18.88	34.20	5.57	59.50
.....	.....	16.15	8.50	20.86	5.01	.....

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand.	Retail Dealer.
	OIL SEED PRODUCTS—*Concluded.*	
	Linseed Meal, Old Process.	
15524	Kellogg's Oil Meal. Spencer Kellogg & Sons, Undercliff, N. J.	*East Haven:* F. A.
		Guaranty
15575	Ground Linseed Cake. Midland Linseed Products Co., Minneapolis, Minn.	*New Britain:* C. Co.
		Guaranty
		Average guaranty
		Average of analyse
		Average digestible
	WHEAT PRODUCTS.	
	Wheat Bran.	
15620*†	The Anthony Mills, Anthony, Kansas	*New Haven:* Crit Benham Co.
		Guaranty
15557	Commander. Commander Mill Co., Minneapolis, Minn.	*Guilford:* Fred. C.
		Guaranty
15602*	Choice. Hecker-Jones-Jewell Milling Co., New York, N. Y.	*Torrington:* D. L.
		Guaranty
15652†	The Hunter Milling Co., Wellington, Kansas.	*New London:* P. S Co.
		Guaranty
15522†	Maple Leaf Milling Co., Limited, Toronto Canada	*East Haven:* F. A.
		Guaranty
15634	Maple Leaf Milling Co., Toronto, Canada	*Rockville:* Rockvill Co.
		Guaranty
15647	Choice. Niagara Falls Milling Co., Niagara Falls, N. Y.	*Norwich:* Chas. Sl Son
		Guaranty
15645	Omar. Omaha Flour Mills Co., Omaha, Neb.	*Yantic:* Yantic (Products Co.
		Guaranty
15545	Thompson Milling Co., Lockport, N. Y.	*Plantsville:* W. H.
		Guaranty
15665*	Washburn-Crosby Co., Minneapolis, Minn.	*New Haven:* R. G. Sons
		Guaranty
		Average guaranty
		Average of analyse
		Average digestible
	Wheat Feed (Mixed Feed).	
15605	Snowflake. Lawrenceburg Roller Mill Co., Lawrenceburg, Ind.	*Winsted:* E. Manc & Sons
		Guaranty
15549*	Pillsbury's. Pillsbury Mills, Minneapolis, Minn	*Plainville:* Eaton E
		Guaranty

*With screenings. † Wire tags.

INSPECTION OF 1920—*Continued.*

Pounds per Hundred.						
Water.	Ash.	Protein (N.x625)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat)	Price per ton.
8.54	5.80	31.06	8.39	39.16	7.05	$70.00
.....	.....	31.00	.....	.....	5.00	.....
9.94	6.21	30.19	8.25	37.73	7.68	72.00
.....	.....	31.00	.....	.....	5.00	.....
....	.....	**31.00**	.....	......	**5.00**	.....
9.24	**6.01**	**30.63**	**8.32**	**38.43**	**7.37**	**71.00**
.....	.....	**27.26**	**4.74**	**29.98**	**6.56**	.....
11.19	6.22	17.81	8.81	51.69	4.28	51.00
.....	.....	14.50	10.00	.....	3.50	.....
9.50	6.61	14.69	11.10	52.82	5.28	49.00
.....	.....	13.00	.....	.....	3.50	.....
9.97	5.56	16.94	9.32	52.62	5.59	48.00
.....	.....	14.50	12.50	51.55	3.75	.....
13.51	6.80	17.25	9.68	48.65	4.11	50.00
.....	.....	14.50	11.00	52.00	3.50	.....
9.10	5.49	17.63	10.37	51.38	6.03	31.00
.....	.....	14.00	10.00	48.00	4.50	.....
9.15	5.13	18.00	9.31	52.99	5.42	50.00
.....	.....	15.50	.....	.....	4.50	.....
12.57	5.60	18.31	12.40	45.25	5.87	48.00
.....	.....	12.00	.....	.....	3.00	.....
9.23	7.18	14.94	9.59	54.44	4.62	48.00
.....	.....	14.50	11.00	50.00	3.50	.....
9.81	6.76	16.13	9.88	52.54	4.88	47.00
.....	.....	11.00	15.00	.....	3.00	.....
10.92	5.06	17.44	10.62	50.15	5.81	.....
.....	.....	13.00	....	....	4.50	.....
.....	.....	**13.65**	**11.59**	**50.39**	**3.73**	.....
10.50	**6.04**	**16.91**	**10.11**	**51.25**	**5.19**	**46.89**
.....	.....	**12.85**	**4.35**	**37.93**	**3.22**	.....
9.14	5.94	16.69	8.90	54.86	4.47	$55.00
....	.....	14.00	.....	.....	3.00	.....
9.89	4.62	16.38	7.64	56.41	5.06	65.00
.....	.....	14.00	.....	.....	4.00	.....

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand.	Retail Dealer.
	WHEAT PRODUCTS—*Concluded.*	
	Wheat Feed (Mixed Feed)—Concluded.	
15556	Occident. Russell Miller Milling Co., Minneapolis, Minn.	*Guilford:* Fred C. M
		Guaranty
15534	Gold Mine. Sheffield King Milling Co., Minneapolis, Minn.	*Ansonia:* Ansonia Grain Co.
		Guaranty
15627	Kent. Williams Bros., Co., Kent, Ohio	*Granby:* E. H. Rolli
		Guaranty
		Average guaranty
		Average of analyses
		Average digestible
	Wheat Middlings.	
15533*	Bay State. Bay State Milling Co., Winona, Wis.	*Ansonia:* Ansonia Grain Co.
		Guaranty
15596*	Big Diamond. Big Diamond Mills Co., Minneapolis, Minn	*Waterbury:* Spencer Co.
		Guaranty
15554*	Madelia. C. S. Christenson Co., Madelia, Minn.	*Branford:* S. V. Osb
		Guaranty
15611	Duluth Universal Milling Co., Duluth, Minn.	*Hazardville:* A. D. Sons
		Guaranty
15640	Shorts. Jas. Goldie Co., Guelph, Ont.	*Willimantic:* Boston Store
		Guaranty
15600*	Hecker-Jones-Jewell Milling Co., New York	*Torrington:* D. L. T
		Guaranty
15529	Black Hawk. International Milling Co., Minneapolis, Minn	*Hamden:* I. W. Bee
		Guaranty
15526	Rex. Maple Leaf Milling Co., Toronto, Canada	*East Haven:* F. A.]
		Guaranty
15616	Alta. Russell Miller Milling Co., Minneapolis, Minn.	*Suffield:* Spencer B
		Guaranty
15539	XXX Comet. Northwestern Consolidated Milling Co., Minneapolis, Minn	*Southport:* C. Buckin Co., Inc.
		Guaranty
15619*	Ogilvie Flour Mills Co., Winnipeg, Canada	*New Haven:* Crit Benham Co.
		Guaranty
15563*	Pillsbury's B. Pillsbury Mills, Minneapolis, Minn	*Wallingford:* A. E.]
		Guaranty
15621	Quaker City. Quaker City Mills Co., Philadelphia, Pa	*New Haven:* R. G. Sons
		Guaranty

*With screenings.

INSPECTION OF 1920—*Continued.*

Pounds per Hundred.						Price per ton.
Water.	Ash.	Protein. (N.x6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat)	
10.35	5.44	18.31	7.89	52.36	5.65	$50.00
.....	.....	15.00	....	.....	4.50	.....
8.54	5.24	16.31	9.08	55.59	5.24	60.00
.....	.....	15.00	.....	.....	4.50	.....
10.67	5.43	16.31	7.50	55.82	4.27	56.00
.....	.....	14.00	.....	......	3.00	.....
.....	.....	**14.40**	.....	.....	**3.80**	.....
9.70	**5.33**	**16.80**	**8.20**	**55.01**	**4.94**	**57.20**
.....	.....	**12.94**	**2.95**	**41.81**	**4.30**	.....
9.27	3.91	16.38	6.78	57.95	5.71	56.00
.....	.....	15.00	.....	.....	4.00	.....
9.28	4.92	16.88	8.45	55.49	4.98	50.00
.....	.....	15.00	.....	....	4.50	.....
10.97	4.86	16.00	7.88	56.23	4.06	60.00
.....	.....	14.00	.....	.....	3.00	.....
8.62	3.44	17.00	4.92	60.54	5.48	60.00
.....	.....	15.00	.....	.....	5.00	.....
9.89	4.04	15.75	5.75	59.95	4.62	50.00
.....	.....	17.00	.....	.....	6.00	.....
9.18	5.08	17.06	7.56	55.88	5.24	50.00
.....	.....	15.50	10.00	54.24	4.50	.....
8.92	4.98	15.38	8.37	56.72	5.63	43.00
.....	.....	14.00	.....	.....	3.50	.....
9.06	4.25	16.75	7.84	55.84	6.26	53.00
.....	.....	16.00	.....	.....	5.50	.....
10.31	4.11	17.00	6.89	55.98	5.71	70.00
.....	.....	15.00	.....	.....	4.50	.....
10.53	2.59	16.69	1.95	63.52	4.72	77.00
.....	.....	16.00	.....	.....	4.00	.....
11.03	4.00	17.50	7.20	54.47	5.77	51.00
.....	.....	13.00	.....	.....	4.00	.....
10.47	5.04	16.06	8.92	54.02	5.49	45.00
.....	.....	14.00	.....	.....	4.00	.....
11.00	4.31	17.50	5.08	56.91	5.20	71.00
.....	.....	14.00	.....	.....	4.00	.....

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS.

Station No.	Manufacturer and Brand.	Retail Dealer
	WHEAT PRODUCTS—*Concluded.* *Wheat Middlings—Concluded.*	
15603*	Pennant. David Stott Flour Mills, Detroit, Mich.	*Torrington:* F. L. & Son
		Guaranty
15558*	Angelus. Thompson Milling Co., Lockport, N. Y.	*Guilford:* Fred C.
		Guaranty
15573*	Standard. Washburn Crosby Co., Minneapolis, Minn.	*New Britain:* C. Co.
		Guaranty
		Average guaranty
		Average of analyse
		Average digestible
	RYE PRODUCTS.	
15562	Feed. Boutwell Mill & Grain Co., Troy, N. Y.	*Wallingford:* A. E.
		Guaranty
15630*	Middlings. Shane Bros. & Wilson Co., Minneapolis, Minn.	*Hartford:* Meech (
		Guaranty
	OAT PRODUCTS.	
15544	Purity Oat Feed. Purity Oat Co., Keokuk, Iowa	*Plantsville:* W. H.
		Guaranty
	MAIZE PRODUCTS. *Corn Gluten Feed.*	
15527	Cream of Corn. American Maize Products Co., New York	*East Haven:* F. A.
		Guaranty
15612	Cream of Corn. American Maize Products Co., Roby, Ind.	*Hazardville:* A. D. Sons
		Guaranty
15528	Buffalo.‡ Corn Products Refining Co., New York	*Hamden:* I. W. Be
		Guaranty
15551	Buffalo. Corn Products Refining Co., New York	*Branford:* S. V. Os
		Guaranty
15625	Globe. Corn Products Refining Co., New York	*Bristol:* Goodsell E
		Guaranty
15561	Hubinger Bros. Co.,‡ Keokuk, Iowa	*North Haven:* W.
		Guaranty
15537	Staley's. A. E. Staley Mfg. Co., Decatur, Ill.	*Southport:* C. Buck Co., Inc.
		Guaranty
15579	Farmer Jones. U. S. Food Products Co., Peoria, Ill.	*New Milford:* Geo.
		Guaranty
		Average guaranty
		Average of analyses
		Average digestible

*With screenings. ‡Statement of dealer.

INSPECTION OF 1920—*Continued.*

ion o.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N.x6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat)	
)3	9.68	4.53	16.13	6.58	58.28	4.80	$32.
.	.....	.....	15.00	.....	.....	4.00	...
8	11.77	3.85	17.75	6.14	55.38	5.11	60.
.	.....	.....	11.00	15.00	.....	3.00	...
'3	12.20	4.06	19.06	6.86	52.02	5.80	65.
.	.....	.....	14.00	.....	.....	4.00	...
.	.....	.....	**14.60**	.....	.....	**4.22**	...
.	**10.13**	**4.25**	**16.81**	**6.70**	**56.82**	**5.29**	**55.**
.	.....	.....	**12.94**	**2.01**	**44.32**	**4.66**	...
2	11.51	3.74	15.06	4.03	62.59	3.07	45.
.	.....	.....	13.50	.....	.....	3.00	...
0	9.81	3.79	17.19	5.04	60.87	3.30	74.
.	.....	.....	15.50	9.00	55.00	3.50	...
14	6.48	7.63	6.06	26.62	51.15	2.06	35.
.	.....	.....	5.00	.....	.....	1.75	...
27	7.11	2.41	24.50	7.38	53.73	4.87	60.
..	.....	.....	23.00	.....	.....	1.50	...
12	7.05	2.47	23.56	6.05	57.32	3.55	65.
..	.....	.....	23.00	8.50	.....	1.50	...
28	8.37	4.76	26.38	5.69	50.09	4.71	60.
..	.....	.....	23.00	.....	.....	1.00	...
51	8.69	5.18	26.44	7.05	50.17	2.47	60.
..	.....	.....	23.00	.....	.....	1.00	...
25	8.83	2.89	26.56	6.04	54.52	1.16	60.
..	.....	.....	23.00	.....	.....	1.00	...
51	9.34	2.05	22.88	5.93	56.41	3.39	62.
..	.....	.....	.....	.....	.....	.....	...
37	7.65	4.60	26.06	7.71	51.73	2.25	63.
..	.....	.....	23.00	.....	.....	1.00	...
79	7.99	2.06	25.94	7.12	49.86	7.03	60.
..	.....	.....	23.00	9.50	.....	2.00	...
..	.....	.....	**23.00**	.....	.....	**1.28**	...
..	**8.14**	**3.30**	**25.30**	**6.62**	**52.98**	**3.68**	**61.**
..	.....	.....	**21.41**	**4.93**	**46.62**	**3.10**	...

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand.	Retail Dealer.
	MAIZE PRODUCTS—*Concluded.* *Corn Meal.*	
15664	....	*New Haven:* R. G. Sons........... Guaranty.........
	Hominy Feed.	
15642	Homco. American Hominy Co., Indianpolis, Ind..................................	*Willimantic:* Bosto Store........... Guaranty.........
15559†	Aunt Jemima Mills Co., St. Joseph, Mo.....	*Guilford:* Fred. C. Guaranty.........
15636	Spring Garden. The Baltimore Pearl Hominy Co., Baltimore, Md..................	*Willimantic:* W Grain Co....... Guaranty.........
15560	Emco. Evans Milling Co., Indianapolis, Ind.	*North Haven:* W. I Guaranty.........
15626	White. Kellogg Toasted Corn Flake Co., Battle Creek, Mich.....................	*Bristol:* Goodsell B Guaranty.........
15604	True Value. Ladish Milling Co., Milwaukee, Wis..................................	*Torrington:* F. L. W Son............ Guaranty.........
15643	Miller Cereal Mills, Omaha, Neb...........	*Yantic:* Yantic Gı Products Co.... Guaranty.........
15538	Choice Steam Cooked. Miner-Hillard Milling Co., Wilkes-Barre, Pa................	*West Cheshire:* G. W Guaranty.........
15570†	The Patent Cereal Co., Geneva, N. Y.......	*Meriden:* August Est............. Guaranty.........
15608	Plymouth's Pure. Plymouth Milling Co., Lemars, Iowa..........................	*Winsted:* E. Manc Sons........... Guaranty.........
		Average guaranty .
		Average of analyses
		Average digestible.
	DISTILLERS' PRODUCTS.	
15609	Eagle. Distillers' Dried Grains, The Dewey Bros., Blanchester, Ohio..................	*Winsted:* E. Manc Sons........... Guaranty.........
	MISCELLANEOUS FEEDS.	
15649	Dried Beet Pulp. Kasco Mills, Inc., Toledo, Ohio.................................	*New London:* Conn Corp........... Guaranty.........
15651	Dried Beet Pulp. Max Hottelet, Milwaukee, Wis..................................	*New London:* P. & Co........... Guaranty.........

†Wire tags.

INSPECTION OF 1920—*Continued.*

Pounds per Hundred.						
Water.	Ash.	Protein. (N.x6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat)	Price per ton.
16.00	1.23	8.44	2.06	68.99	3.28	$.....
.....	.....	.....	.....	.....	.....	.....
7.92	2.62	11.25	4.51	65.44	8.26	45.00
.....	.....	10.00	6.00	.....	6.00	.....
9.99	3.44	12.19	5.82	63.38	5.18	50.00
.....	.....	10.00	8.00	65.00	5.00	.....
8.82	2.46	10.94	4.58	67.21	5.99	50.00
.....	.....	10.00	6.00	60.00	5.00	.....
9.74	2.98	11.75	5.02	60.45	10.06	49.00
.....	.....	10.00	7.00	.....	7.50	.....
9.68	2.73	11.44	4.16	63.22	8.77	56.00
.....	.....	10.00	5.00	55.00	6.00	.....
7.35	2.30	10.94	3.48	69.20	6.73	33.00
.....	.....	10.50	5.00	.....	5.00	.....
9.17	2.91	11.44	4.69	63.47	8.32	50.00
.....	.....	10.00	4.00	65.00	7.00	.....
10.19	2.44	11.19	5.13	65.69	5.36	49.00
.....	.....	10.00	5.00	.....	4.00	.....
10.23	2.44	11.13	5.55	64.03	6.62	50.00
.....	.....	10.00	.....	.....	5.00	.....
7.98	2.20	10.75	4.20	67.32	7.55	52.00
.....	.....	10.00	.....	.....	8.50	.....
.....	.....	10.05	6.00	.....	5.90	.....
9.11	2.65	11.30	4.71	64.94	7.29	48.40
.....	.....	8.78	3.58	58.45	6.63	.....
5.23	1.71	32.69	11.02	35.95	13.40	72.00
.....	.....	30.00	13.00	30.00	10.00	......
10.73	3.38	9.00	18.84	56.18	1.87	60.00
.....	.....	9.00	18.00	.....	0.50	.....
9.40	3.26	9.00	20.24	56.63	1.47	60.00
.....	.....	8.00	20.00	60.00	0.50	.....

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand.	Retail Dealer.
	MISCELLANEOUS FEEDS—*Concluded.*	
15565	Dried Beet Pulp. Larrowe Milling Co., Detroit, Mich.	*Wallingford:* A. E. I Guaranty Average guaranty Average of analyses Average digestible
15658	Cocoanut Oil Meal. Oil Seeds Co., Bayonne, N. J.	*Middletown:* Meech dard, Inc. Guaranty
15657	Beta Brand Peanut Oil Meal. Oil Seeds Co., Bayonne, N. J.	*Middletown:* Meech dard, Inc. Guaranty
	PROPRIETARY MIXED FEEDS. *Horse, Dairy and Stock Feeds.*	
15655	Blatchford's Calf Meal. Blatchford Calf Meal Co., Waukegan, Ill.	*Middletown:* Meech dard, Inc. Guaranty
15525	Schumacher's Calf Meal. Quaker Oats Co., Chicago, Ill.	*East Haven:* F. A. F Guaranty
15639	Ryde's Cream Calf Meal. Ryde & Co., Chicago, Ill.	*Willimantic:* Wil Grain Co. Guaranty
15632	Hamlin Quality Horse Feed. Dwight Hamlin, Pittsburgh, Pa.	*Hartford:* Meech Gr Guaranty
15577	Peter's King Corn Horse and Mule Feed. M. C. Peters Mills Co., Omaha, Neb.	*Shelton:* Ansonia F Grain Co. Guaranty
15572	Purina O-Molene Feed. Purina Mills, St. Louis	*Meriden:* August Est. Guaranty
15622	Farmer Jones Horse Feed. U. S. Food Products Co., Peoria, Ill.	*New Haven:* R. G. Sons Guaranty
15656	Pioneer Hog Feed. Hales & Edwards Chicago, Ill.	*Middletown:* Meech dard, Inc. Guaranty
15566	Barford's Ready Ration for Growing Pigs. Meech & Stoddard, Inc., Middletown	*Meriden:* Meriden C Coal Co. Guaranty
15594	Go-Tu-It Hog Ration. Park & Pollard Co., Boston	*Norwalk:* C. E. Slau Guaranty
15576	Peters Hog Profit. M. C. Peters Mill Co., Omaha, Neb.	*Shelton:* Ansonia Flo Grain Co. Guaranty
15571	Purina Pig Chow. Purina Mills, Buffalo, N. Y.	*Meriden:* August Est. Guaranty

INSPECTION OF 1920—*Continued.*

on	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein! (N.x6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat)	
	6.95	3.28	8.56	19.30	61.20	0.71	$58.0
	.....	.....	8.00	20.00	58.00	0.50	.....
	.....	.....	**8.33**	**19.33**	**59.00**	**0.50**	....
	9.03	**3.31**	**8.85**	**19.46**	**58.00**	**1.35**	**59.3**
	.....	.....	**4.60**	**16.15**	**48.14**	.....	....
	12.96	8.44	19.06	12.28	35.17	12.09	....
	.....	.....	20.00	.....	.....	7.00	....
	14.51	6.20	27.94	10.81	27.84	12.70	....
	.....	.....	30.00	10.00	.....	7.00	....
	13.96	6.00	23.19	8.31	43.76	4.78	130.0
	.....	.....	24.00	.....	.....	5.00	....
	7.74	5.21	19.50	2.06	57.51	7.98	115.0
	.....	.....	18.00	.....	.....	8.00	....
	8.17	5.39	25.19	6.53	49.79	4.93	140.0
	.....	.....	25.00	.....	.....	5.00	....
	7.57	7.89	9.00	13.65	59.86	2.03	62.0
	.....	.....	9.00	14.00	.....	1.50	....
	7.96	6.44	11.06	16.06	56.25	2.23	65.0
	.....	.....	10.00	.....	.....	1.50	....
	9.72	3.87	10.56	6.37	65.38	4.10	58.0
	.....	.....	9.75	.....	.....	3.00	....
	9.54	3.85	10.94	7.18	64.66	3.83	60.0
	.....	.....	10.00	.....	.....	2.50	...
	12.30	5.48	16.88	9.03	52.99	3.32	58.0
	.....	.....	15.00	.....	.....	4.00	....
	9.64	4.43	18.75	6.90	53.68	6.60	61.0
	.....	.....	18.00	.....	.....	5.00	....
	8.43	9.74	18.25	6.95	50.71	5.92	75.0
	.....	.....	15.00	.....	.....	6.00	....
	10.88	6.28	19.25	5.63	52.95	5.01	88.0
	.....	.....	17.00	.....	.....	4.00	....
	11.63	8.78	17.06	5.47	52.71	4.35	65.0
	.....	.....	15.00	9.00	59.00	2.50	....

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand.	Retail Dealer.
	PROPRIETARY MIXED FEEDS—*Continued.*	
	Horse, Dairy and Stock Feeds—Continued.	
15615	Portage Stock Feed. Akron Feed & Milling Co., Akron, Ohio........................	*Thompsonville:* Geo.S. & Co............ Guaranty..........
15536	Armour's Stock Feed. Armour Grain Co., Chicago, Ill............................	*Southport:* C. Bucking Co., Inc.......... Guaranty...........
15617	Wirthmore Stock Feed. Chas. M. Cox Co., Boston, Mass............................	*Suffield:* Spencer Bro Guaranty...........
15641	Crosby's Stock Feed. E. Crosby & Co., Brattleboro, Vt........................	*Willimantic:* Boston Store............. Guaranty...........
15637	Grandin's Stock Feed. D. H. Grandin Milling Co., Jamestown, N. Y................	*Willimantic:* Willim Grain Co......... Guaranty...........
15653	Stock Feed. Hales & Edwards,‡ Chicago, Ill..................................	*New London:* P. Sw Co............... Guaranty...........
15614	Krause Stock Feed. Charles A. Krause, Milwaukee, Wis........................	*Thompsonville:* Geo Phelps & Co...... Guaranty...........
15583	Bull Brand Stock Feed. Maritime Trading Corp., Buffalo, N. Y....................	*New Milford:* Geo Ackley........... Guaranty...........
15587	M. & S. Stock Feed. Meech & Stoddard, Inc., Middletown, Conn......................	*Danbury:* H. E. Meel Guaranty...........
15650	Old Honesty Stock Feed. Oswego Milling Co., Oswego, N. Y......................	*New London:* P. Schw Co............... Guaranty...........
15610	Schumacher Feed. Quaker Oats Co., Chicago, Ill..................................	*Hazardville:* A. D. I Sons............. Guaranty...........
15531	Vitality Stock Feed. Rosenbaum Bros., Chicago, Ill............................	*Hamden:* I. W. Beers Guaranty...........
15646	Haskell's Stock Feed. Sheets Elevator Co., Haskell Mills, Toledo, Ohio..............	*Norwich:* Charles S. Sons............. Guaranty...........
15530	Armour's Dairy Feed. Armour Grain Co., Chicago..............................	*Hamden:* I. W. Beers Guaranty...........
15553†	Acorn Dairy Feed. Chapin & Co., Hammond, Ind..................................	*Branford:* S. V. Osbo Guaranty...........
15589	Unicorn Dairy Ration. Chapin & Co., Hammond, Ind............................	*Danbury:* F. C. Be Guaranty...........
15541	Wirthmore Balanced Ration for Milch Cows. Chas. M. Cox Co., Boston, Mass........	*West Cheshire:* G. W.I Guaranty...........
15629	Crosby's Quality Feed Dairy Ration. E. Grosby & Co., Brattleboro, Vt................	*Hartford:* Meech Grai Guaranty...........

†Wire tags. ‡Statement of dealer.

Inspection of 1920—Continued.

Pounds per Hundred.						Price per ton.
Water.	Ash.	Protein. (N.x6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat)	
8.35	4.27	10.13	10.96	61.54	4.75	$55.00
.....	.....	8.50	10.00	.....	4.00	.....
6.99	4.78	12.63	12.47	58.20	4.93	50.00
.....	.....	12.00	.....	.....	4.00	.....
8.03	3.68	10.50	8.73	63.76	5.30	60.00
.....	.....	9.00	.....	.....	4.00	.....
9.16	2.94	10.44	7.03	65.25	5.18	48.00
.....	.....	9.00	10.00	60.00	4.00	.....
8.55	3.73	9.13	10.50	62.36	5.73	50.00
.....	.....	10.00	.....	.....	4.00	.....
10.80	5.43	12.56	10.46	57.58	3.17	50.00
.....	.....	10.00	.....	.....	4.00	.....
8.76	2.88	10.31	7.87	66.90	3.28	55.00
.....	.....	9.00	.....	.....	3.00	.....
8.70	4.72	13.81	8.77	58.71	5.29	60.00
.....	.....	11.00	12.00	60.00	4.00	.....
8.53	3.85	10.63	9.85	61.74	5.40	60.00
.....	.....	9.00	.....	.....	3.00	.....
10.16	4.64	11.25	11.46	58.60	3.89	50.00
.....	.....	10.00	.....	.....	3.00	.....
9.29	5.50	11.00	9.26	61.80	3.15	55.00
.....	.....	10.00	.....	.....	3.25	.....
7.86	7.04	10.31	12.24	58.80	3.75	55.00
.....	.....	12.00	.....	.....	3.00	.....
7.39	3.27	9.63	9.75	63.75	6.21	50.00
.....	.....	9.00	.....	.....	6.00	.....
7.09	7.25	27.69	13.55	38.48	5.94	72.00
.....	.....	22.00	.....	.....	5.00	.....
9.12	6.23	20.00	8.17	51.93	4.55	70.00
.....	.....	20.00	10.00	.....	3.00	.....
8.41	6.96	24.88	7.49	46.36	5.90	72.00
.....	.....	24.00	.....	.....	4.50	.....
8.99	5.32	24.19	10.60	45.85	5.05	65.00
.....	.....	24.00	.....	.....	5.00	.....
8.85	4.93	23.88	10.47	46.23	5.64	73.00
.....	.....	25.00	.....	.....	5.00	.....

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS.

Station No.	Manufacturer and Brand.	Retail Dealer.
	PRORPIETARY MIXED FEEDS—*Continued.*	
	Horse, Dairy and Stock Feeds—Continued.	
15599	Eshelman's 20 Dairy Feed. John W. Eshelman & Sons, Lancaster, Pa.	*Torrington:* D. L. Guaranty
15588	Eshelman's 24 Dairy Feed. John W. Eshelman & Sons, Lancaster, Pa.	*Danbury:* F. C. Guaranty
15638	Grandin's Twin-Six Dairy Feed. D. H. Grandin Milling Co., Jamestown, N. Y.	*Willimantic:* Willi Grain Co. Guaranty
15623	Al Grane Milk Feed. H-O Co.'s Mills, Buffalo, N. Y.	*Bristol:* Goodsell B Guaranty
15547	National Dairy Feed. Ladish Milling Co., Milwaukee, Wis.	*Plantsville:* W. H. C Guaranty
15613	Larro Feed for Dairy Cows. Larrowe Milling Co, Detroit, Mich.	*Thompsonville:* G Phelps & Co. Guaranty
15607	Red Star Dairy Feed. E. Manchester & Sons, Winsted, Conn.	*Winsted:* E. Manc Sons. Guaranty
15567	Barford's Balanced Dairy Ration. Meech & Stoddard, Middletown, Conn.	*Meriden:* Meriden Coal Co. Guaranty
15633	Barford's Balanced Dairy Ration. Meech & Stoddard, Inc., Middletown, Conn.	*Hartford:* Meech Guaranty
15597	Steven's 44 Dairy Ration. Park & Pollard Co., Boston, Mass.	*Waterbury:* Spenc Co. Guaranty
15574	Pillsbury's Dairy Ration. Pillsbury Flour Mill Co., Minneapolis, Minn.	*New Britain:* C. Co. Guaranty
15592	Purina Cow Chow. Purina Mills, Buffalo, N. Y.	*Norwalk:* C. E. Sla Guaranty
15591	Protena More Milk Dairy Feed. Purina Mills, St. Louis	*Norwalk:* C. E. Sla Guaranty
15535	Big Q Dairy Ration. Quaker Oats Co., Chicago, Ill.	*Ansonia:* Ansonia Grain Co. Guaranty
15590	Quaker Dairy Feed Without Molasses. Quaker Oats Co., Chicago	*Danbury:* F. C. Be Guaranty
15546	Syragold Milk Ration. Syracuse Milling Co., Syracuse, N. Y.	*Plantsville:* W. H. Guaranty
15578	Ti-O-Ga Dairy Feed. Tioga Mill & Elevator Co., Waverly, N. Y.	*New Milford:* Geo. Guaranty
15644	Biles Ready Dairy Ration. The Ubiko Milling Co., Cincinnati, Ohio	*Yantic:* Yantic G Products Co. Guaranty
15550	Fourex Dairy Ration. The Ubiko Milling Co., Cincinnati, Ohio	*Plainville:* Eaton B Guaranty

INSPECTION OF 1920—*Continued.*

Pounds per Hundred.						
Water.	Ash.	Protein (N.x6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat)	Price per ton.
9.81	7.34	17.56	12.03	48.34	4.92	$68.00
.....	.....	20.00	.....	.....	4.00	.....
7.83	6.44	25.50	11.85	42.50	5.88	70.00
.....	.....	24.00	.....	.....	5.00	.....
7.53	6.09	22.31	12.03	46.67	5.37	60.00
.....	.....	22.00	.....	.....	5.00	.....
9.47	6.21	15.38	11.28	53.55	4.11	60.00
.....	.....	14.00	15.00	.....	4.00	.....
9.59	6.18	25.13	8.76	44.14	6.20	70.00
.....	.....	20.00	12.00	55.00	4.00	.....
7.82	5.72	22.31	10.23	49.40	4.52	75.00
.....	.....	20.00	.....	.....	3.00	.....
8.42	5.11	24.50	8.79	46.50	6.68	67.00
.....	.....	23.00	10.00	.....	4.00	.....
9.24	4.90	21.50	8.40	47.98	7.98	60.00
.....	.....	19.00	.....	.....	5.50	.....
7.92	5.38	19.13	9.03	51.41	7.13	78.00
.....	.....	19.00	.....	.....	5.50	.....
6.94	8.37	26.88	10.86	38.47	7.48	75.00
.....	.....	24.00	.....	.....	5.00	.....
8.61	6.82	19.38	10.14	50.23	4.82	72.00
.....	.....	19.00	.....	.....	4.00	.....
8.58	6.43	26.56	10.74	43.17	4.52	75.00
.....	.....	24.00	12.00	53.00	4.30	.....
8.20	7.12	18.75	10.13	51.30	4.50	60.00
.....	.....	16.50	.....	.....	3.50	.....
7.46	5.22	22.06	10.78	48.97	5.51	73.00
.....	.....	22.00	.....	.....	5.00	.....
7.68	9.08	16.69	13.57	48.25	4.73	65.00
.....	.....	16.00	.....	.....	4.50	.....
9.50	5.76	20.56	17.74	42.11	4.33	70.00
.....	.....	20.00	15.00	43.00	4.50	.....
9.32	6.88	29.06	8.06	41.60	5.08	68.00
.....	.....	23.00	11.00	.....	3.50	.....
7.83	5.28	24.13	8.29	47.71	6.76	70.00
.....	.....	24.00	10.00	50.00	5.00	.....
8.89	6.74	20.81	10.55	48.56	4.45	65.00
.....	.....	20.00	12.00	52.00	4.00	.....

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand.	Retail Dealer.
	PROPRIETARY MIXED FEEDS—*Concluded.* *Horse, Dairy and Stock Feeds—Concluded.*	
15552	Big Repeater Dairy Ration. U. S. Feed Association, Toledo, Ohio................	*Branford:* S. V. Osl Guaranty..........
15542	Farmer Jones Dairy Feed. U. S. Food Products Co., Peoria, Ill................	*West Cheshire:* G. W Guaranty..........
15543	Success Dairy Feed. U. S. Food Products Co., Peoria, Ill..............................	*West Cheshire:* G. W Guaranty..........
15667	Dairy Feed..............................	*New Haven:* R. G. Sons........... Guaranty..........
	POULTRY FEEDS.	
15585	Blatchford's Fill the Basket Egg Mash. Blatchford Calf Meal Co., Wauregan, Ill. .	*New Milford:* Geo.] Guaranty..........
15569	Iroquois Poultry Mash. Buffalo Cereal Co., Buffalo, N. Y.........................	*Meriden:* Meriden Coal Co........ Guaranty..........
15582	Wirthmore Mash Feed. Chas. M. Cox. Boston, Mass..........................	*New Milford:* Geo. Guaranty..........
15624	H. O. Co.'s Laying Mash. H. O. Co.'s Mills. Buffalo, N. Y.........................	*Bristol:* Goodsell B Guaranty..........
15568	M. & S. Dry Mash. Meech & Stoddard, Middletown, Conn.........................	*Meriden:* Meriden Coal Co........ Guaranty..........
15648	Mystic Laying Mash. Mystic Milling & Feed Co., Rochester, N. Y..................	*Norwich:* Chas. Sh Son............ Guaranty..........
15593	Lay or Bust. Park and Pollard Co., Boston, Mass................................	*Norwalk:* C. E. Sla Guaranty..........
15618	Purina Chicken Chowder. Purina Mills, St. Louis.............................	*New Haven:* Cr Benham Co..... Guaranty..........
15595	Full-O-Pep Growing Mash. Quaker Oats Co., Ill....................................	*Norwalk:* C. E. Sla Guaranty..........

15334. Beef Scrap, sent by H. H. Johnson, County Age Norwich, contained 55.88 per cent. of protein.

14350. Cane Molar, molasses used in the preparation of sto feeds was found to contain only a trace of sulphur dioxide.

Condimental Foods, Tonics, etc. **14468.** Sample sent by M George Middleton, North Windham, consisted of mixed grou grains, mainly corn, oats and wheat. No evidence of medicame was found.

15441. Stock Feed Tonic, sent by B. S. Dibble, East Cana consisted of, or contained, salt, charcoal, partially digested star

INSPECTION OF 1920—*Concluded.*

Pounds per Hundred.						Price per ton.
Water	Ash.	Protein (N.x6.25).	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat)	
8.84	5.36	22.88	9.21	48.55	5.16	$70.00
.....	.....	22.00	.....	.....	5.00	.....
8.85	7.28	24.50	7.54	47.01	4.82[1]	65.00
.....	.....	20.00	.....	.....	5.00	....
9.39	7.80	22.81	7.20	48.38	4.42	60.00
.....	.....	16.00	.....	.....	4.00	.....
11.67	3.44	19.44	7.01	53.26	5.18	.....
.....	.....	.....	.....	.....	.....	.....
8.18	14.43	21.31	8.72	42.05	5.31	100.00
.....	.....	19.00	.....	.....	4.00	.....
8.86	5.08	16.25	8.04	55.80	5.97	63.00
.....	.....	15.00	.....	.....	4.00	.....
9.77	9.43	23.13	5.69	46.64	5.34	78.00
.....	.....	20.00	.....	.....	4.00	.....
9.20	10.88	20.00	5.23	49.23	5.46	75.00
.....	.....	17.00	6.00	.....	4.50	.....
9.62	8.68	19.81	6.63	49.01	6.25	60.00
.....	.....	12.00	.....	.....	3.00	.....
11.85	8.60	23.75	9.60	41.93	4.27	78.00
.....	.....	23.00	.....	.....	.4.00	.....
8.52	12.04	18.19	7.62	49.76	3.87	75.00
.....	.....	18.00	.....	.....	1.50	.....
9.50	7.46	20.06	8.51	49.71	4.76	81.00
.....	.....	18.00	.....	.....	4.00	.....
8.24	9.60	19.63	4.88	52.58	5.07	90.00
.....	.....	17.00	.....	.....	5.25	.....

By modified method; 4.52 by regular method.

FEEDS SUSPECTED OF CONTAINING FOREIGN OR INJURIOUS MATERIALS.

15252. Oats suspected of having been sulphured, sent by R. E. [acey, West Haven. No evidence of bleaching was obtained.

15305. Shelled corn and peanut feed, sent by Mrs. William ord, Noroton Heights, was referred to the Department of Ento-ology. Dr. Britton reported the sample to be moderately infested ith the rice weevil and slightly infested with the Indian meal moth.

14982. Scratch Feed and **14983.** Chick Feed, sent by E. John-›n, Thomaston. There was nothing suspicious about the sub-ance of the feeds but **14982,** in our opinion, was entirely too)arse for young chicks.

CONNECTICUT
Agricultural Experiment Station
NEW HAVEN, CONN.

BULLETIN 230 **JUNE, 1921**

ENTOMOLOGICAL SERIES, No 29

THE GRASS-FEEDING FROG-HOPPER OR SPITTLE-BUG

BY PHILIP GARMAN

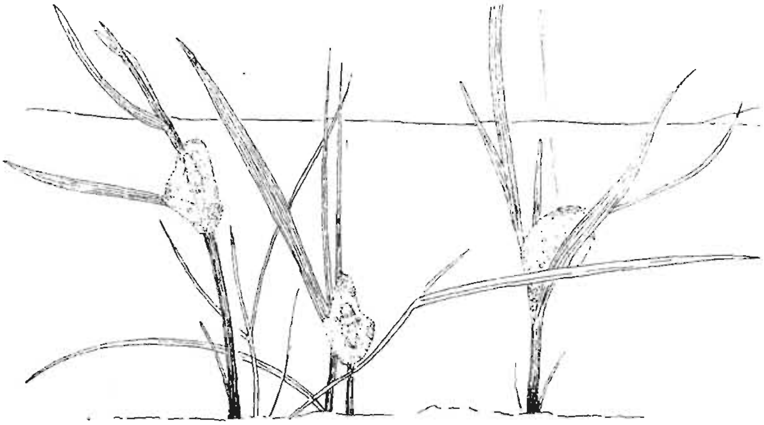

Figure 17. Spittle balls containing nymphs on grass stems

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The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the edition permits.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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June, 1921.

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Press of The Wilson H. Lee Company.

The Grass-Feeding Frog-Hopper or Spittle-Bug

(*Philaenus lineatus* Linnaeus)

Order *Hemiptera* Family *Cercopidae*

By Philip Garman, Ph.D.

Frog-hopper or spittle-bug balls are often observed on shrubbery or herbaceous plants, in waste or uncultivated fields. Those of the grass-feeding species are especially noticeable in meadows and may cause persons not acquainted with them to speculate—often blindly—concerning their probable nature. Such speculations are mainly confined to the belief in "frog-spit" and "snake-spit," though occasionally we find people who think them the young of grasshoppers. The term "frog-hopper," which has grown out of the unfounded belief that spittle balls are voided by tree-frogs, is not inappropriate when applied to the adult bug because of its squat appearance and hopping ability.

In favorable locations frog-hoppers may become abundant and no doubt do considerable damage. In one instance the writer counted fourteen balls on grass plants within a square foot, which shows the relative abundance of frog-hoppers under some conditions. About New Haven they do not become sufficiently numerous to do serious damage, but they contribute to the sum total of injury caused by leaf-hoppers, grasshoppers and thrips, and may be counted a pest for this reason.

Frog-hoppers are sucking insects which make use of the sap drawn from the plant, to form their protective spittle. Any withdrawal of sap in this way naturally weakens the plant, and the stem upon which the insect has fed may become stunted or may not produce seed.

Orchard grass, timothy, red top and blue grass are infested in Connecticut, while Osborn[5] reports it also from Canada blue grass in Maine. The adults likewise feed on grass shoots but apparently do not do as much damage as the nymphs.

Those who have studied the life histories of American Cercopidae have not reported direct field observation of the egg stage of any of them; nor have they followed these insects through their complete cycle from egg to egg or adult to adult.

Some of the missing links in our chain of information have been observed for the grass-feeding spittle-bug and an effort has been made to follow it through its life cycle by observations in the field, insectary and laboratory. These facts are herein recorded.

History

Osborn[5] studied the species of Maine Cercopidae and his observations are of especial value. He says of the grass-feeding species

that it lives through the winter in the egg stage. The eggs hatch late in May or early in June, and the nymph passes through several stages (3-4) before the adult emerges. Adults were obtained in Maine the first part of July and probably mate there in August. Egg laying is extended over "some weeks in autumn." Ball in his summary of the life history of Cercopidae[1] says that all species except one pass the winter in the egg stage.

The Egg

Confined in small wire cages placed over grass planted in flower pots, the adult bugs were induced to mate and lay eggs. The eggs are laid between the leaf and the main stem (Fig. 18. e), are usually placed diagonally to the stem, and within two or three inches of the ground. They are firmly attached to the plant, either to leaf or stem. As many as eleven have been found in one group but they are sometimes laid singly. Cage records indicate that four or five are usually deposited together.

In 1920 eggs were obtained on the following dates from adult females brought from the field and mated in the insectary:—July 12, 16, 25, 29; August 2, 3, 5, 7, 8, 10, 11, 14, 15, 19, 21, 31; September 9, 12 and 20. In 1921 the first eggs were obtained July 7, but could probably have been obtained earlier judging from the time of adult emergence. In 1920 adults were mated July 1, but no eggs were obtained. Of the eggs obtained in 1920, those laid on July 19, 25, 29; August 5, 6, 7, 12, 14, 26; September 7, 9 and 17, hatched the following spring, the period of incubation varying from 228 to 281 days.

Table Giving Data on the Length of the Egg Stage.

Eggs Laid	Eggs Hatched	Length of Period (Days)
July 19, 1920	April 26, 1921	281
July 25, 1920	May 6, 1921	275
July 29, 1920	April 27, 1921	272
August 5, 1920	April 30, 1921	268
August 5, 1920	April 27, 1921	265
August 5, 1920	April 27, 1921	265
August 8, 1920	April 25, 1921	260
August 7, 1920	April 30, 1921	266
August 8, 1920	April 26, 1921	261
August 9, 1920	April 30, 1921	264
August 10, 1920	April 20-26, 1921	253-259
August 14, 1920	April 26, 1921	255
August 14, 1920	April 25, 1921	254
August 15, 1920	April 26, 1921	254
August 14, 1920	April 26, 1921	255
August 14, 1920	April 25, 1921	254
August 31, 1920	April 26, 1921	239
September 9, 1920	April 25, 1921	228
September 12, 1920	April 28, 1921	228
September 17, 1920	May 8, 1921	233

It is interesting to note in addition to the fact that the incubation period varied from 228-281 days in 1920-'21, that the eggs laid between July 19-September 17 hatched within a short time of one another. These eggs were all placed out of doors as soon as laid and brought to the insectary after frost. Furthermore, it was noted in field cages that all hatched about the same time in 1920; viz., April 20, and that young were first seen in the field about this time both in shaded and exposed situations.

The Nymph

The nymph passes through four instars, and the nymphal stage lasts about forty-five days, according to field observations. In 1920 spittle balls were observed from June 1 to August 13, though most of them disappeared about July 4. In 1921 nymphs were present in field cages from April 20 to June 14. The average sum of the different stages obtained in the insectary totals twenty-eight days, and it seems probable that the usual period lies between twenty-eight and forty-five days in this latitude, though possibly more, or less.

The first stage nymphs lived in 1921 from—

April 27 to May 10	13 days
April 20 to May 3	13 days
April 26 to May 11	15 days
April 26 to May 10	15 days
April 26 to May 11	15 days
April 28 to May 11	13 days
April 26 to May 11	15 days

The mean hourly temperature in the insectary during the period from April 26 to May 11 was 56° F; maximum 76°; minimum 45° F. During 19 hours of this period the temperature registered below 50° F.

The second stage collected from the field in 1920 lived from:—

June 8 to June 12	4 days
June 8 to June 9	1 day.

Data on this stage are very unsatisfactory. Two specimens in the third instar collected from the field in 1920 lived from June 8 to June 12, four days, but these also are unsatisfactory data.

The fourth instar in 1920 lived from:—

June 12 to June 20	8 days
June 9 to June 20	11 days
June 12 to June 18	6 days
June 8 to June 18	10 days
June 8 to June 15	7 days

Osborn reared this stage in Maine in 2-6 days.

In field cages, nymphs hatched about April 20, and the first adults were seen June 14. Insectary temperature during this period varied from 45° - 82° F. The mean hourly temperature during April (April 26 to May 1) was 60.1° F., during May, 57.1° F; and during June (1-14) 60.3° F. For about 60 hours of this period the temperature was below 50° F.

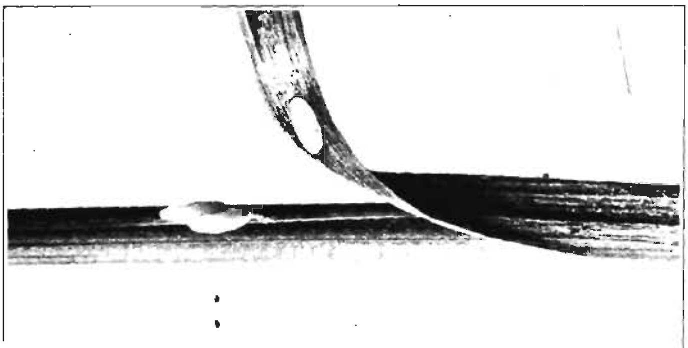
Habits of the Nymph

The newly emerged nymph has a yellow spot on each side of the abdomen. These spots probably mark the location of the spittle glands, the openings of which are on the seventh and eighth segments. While some of the material for the spittle comes from the anal opening, a great part must come from these abdominal glands, the substance flowing beneath the abdomen where it is filled with air bubbles. The apparatus for filling the mass with air bubbles is curious and is connected with a special adaptation for supplying air to the insect itself. In young nymphs the ventral surface of the abdomen is covered with a film of gelatinous material, allowing a space beneath it which connects with the space between the flap-like plates of the terminal segments. Air is drawn beneath this film, the insect keeping the tip of the abdomen above the surface when quiet. Spiracles connecting with air tubes are located on the ventral surface, between pleura and sterna and are covered by the film, in young specimens, and by a series of overlapping plates—extensions of the pleura—in older ones. The insect is enabled in this way to obtain a continual supply of air and at the same time remain submerged in the spittle. When the insect desires to expand the froth it sticks the abdomen above the spittle, encloses an air bubble within the two terminal flaps, brings it beneath the surface and forces it out. Some species, however, are able to work faster. Placing the tip of the abdomen near the surface of the spittle they roll the terminal flaps together rapidly, taking air in and expelling it beneath the surface of the spittle, at the same time moving the tip of the abdomen but little.

Expansion of the froth with air serves to hide the nymph and makes excessive secretion unnecessary. During nymphal life the bug may construct several balls but there is usually little migration after the first mass is formed. Moults take place within the froth and in the case of the grass-feeding frog-hopper, the adult also develops within where it hardens sufficiently to enable it to fly. Thus during nymphal life at least, the grass-feeding spittle-bug is protected from predaceous and parasitic enemies and partly from adverse climatic conditions. Lack of moisture seems to prevent development of the younger stages which depend largely on tender rapidly growing shoots as a food supply. The result is seen in their more frequent occurrence in low damp places than in higher well drained pastures.

a. Spittle balls on grass About natural size Photo by Walden.

b. Adult bug. Six times natural size.



a. Field with spittle-masses. Photo by Walden.

Grass infested with frog-hoppers, showing spittle-masses. Photo by Walden.

Composition of the Froth

Osborn[5] says that the froth mass is only partly soluble in water. This is true since the balls often remain on the stems after showers. The substance is more readily soluble in sodium hydroxide, but is not easily soluble in 80% alcohol. It probably contains some starch or converted sugar, though there is no reaction to iodine. The "albuminous" substance is not coagulated with heat. The material of spittle balls offers an ideal medium for molds and bacteria which may sometimes be found in large numbers.

The Adult

Adults were collected from grass plots near the Station from June 15 to November 9, 1920, and specimens were taken on May 29, 1921, by Mr. Walden. None could be found in the spring of 1921, prior to May 29, in the field where spittle balls and adults were numerous in 1920. None of the adults survived in field cages, although some laid eggs which hatched the following spring. About two dozen adults in a field cage disappeared completely during the summer but laid eggs which hatched about April 20. Another field cage contained two dozen nymphs; all were adult July 4, and they lived in this state until about August 16, when no live individuals could be found. Eggs were laid by these bugs, and recently hatched nymphs were found April 20, 1921.

The adults apparently lay but few eggs. In breeding cages not over one dozen eggs could be obtained from a single female, though it is probable that they may lay more under suitable conditions. Most individuals laid one or two lots of eggs consisting of four or five each, and then died, in spite of efforts to keep them alive and obtain more eggs. Two gravid females collected in the field August 27, contained 4 and 12 well developed eggs respectively, while two others collected in July contained 0 and 4 eggs.

The period elapsing between emergence of the adult and egg laying is about a month. In 1920 adults were obtained in the field June 15 and the first eggs could not be secured until July 12, although attempts were made several times previous to this date. In 1921, with a much more advanced season, freshly emerged adults were taken in the field by Mr. Walden, May 29, and the first eggs were obtained July 6 from confined bugs brought to the insectary. Mating takes place from the first of July until October, at least in this locality.

The length of life of the adult in field cages was about one month and a half, but observations on unconfined specimens indicate a longer period—two to two and one-half months or more. Thus in a grass plot near the Station, no spittle balls were seen after the first of July, yet adults were collected here until November 9.

Eggs were laid in small cages, within two or three days after mating.

The adult bug is comparatively sluggish most of the time. It remains on the stems of grass plants, and is not easily disturbed. If poked with a stick it moves leisurely up or down but never rapidly. If it receives a more violent poke or blow it responds with a tremendous hop, landing a foot or more away from the original position. If followed, it will usually be found lying feet upwards on the ground or head downwards in the grass, and a second blow will fail to react on it until it has had time to regain its feet. The bugs are most active towards evening, lying almost inactive during the morning.

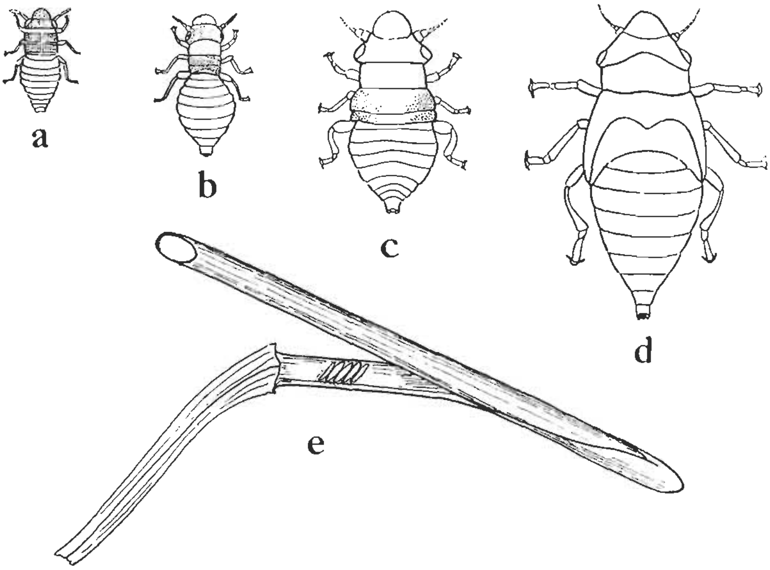


Figure 18. The egg and the nymphal instars of the grass-feeding spittle-bug. a. First instar. b. Second instar. c. Third instar. d. Fourth instar. e. Diagram showing the usual position of the egg.

Description of the Different Stages

Egg (Fig. 18; Pl. XVIII, c.)—The egg is elongate, slightly curved and flattened a little and is usually embedded in a whitish adhesive substance. The surface is smooth. When first laid it is nearly white, but turns light brown with age. There is often a yellowish tint at one end.

Total length about .75-1 mm.

First Instar (Fig. 18, a.)—This stage has the head and thorax and also the legs, dark brown. The abdomen is yellowish white with a darker yellow spot on each side below. The antennae consist of two distinct divisions, the distal division having a number of indistinct annuli. The proximal division has two indefinite segments.

Length of alcoholic specimens 1.2-1.5 mm.

Second Instar (Fig. 18, b.)—This instar is similar in nearly all respects to the first instar except that the prothorax now lacks brown pigment.

The antennae are a little more plainly divided into segments but the two main divisions are still evident. The yellow spots of the abdomen are smaller.

Length of alcoholic specimens 2-3 mm.

Third Instar (Fig. 18, c)—During this stage the abdominal yellow spots disappear, the head loses its brown color, and the wing pads are much more developed. The antennal segments may now be counted with ease.

Length of alcoholic specimens 3.5-4.5 mm.

Fourth Instar (Fig. 18, d)—This stage lacks the brown color of the thorax and head, the entire insect being pale. Antennae are well developed, distinctly segmented and not separated into two divisions as in the first and second instar. The wing pads are well developed, now extending to the caudal margin of the first abdominal segment, and the sexes are easily distinguished with the aid of a microscope.

Length (alcoholic specimens) 5 mm.

Adult, male (Pl. XVIII, b)—Color brown with a pale stripe along each side on the costal margins of the elytra. Head brown, eyes black, the front below marked with arcuate black lines; lora dark brown or black. Venter of thorax and abdomen, and also the tarsal claws black. There is usually a darker stripe on each elytron above the pale costal stripe. The hind legs in common with other spittle-bugs have the tibiae and first two tarsal segments greatly expanded at their tips and spinose.

Length 4.5-5.5 mm; width of head across the eyes 1.5-1.8 mm; greatest width across the elytra when folded 1.8-2 mm.

Female —Similar to the male but slightly larger and the elytra less definitely marked. The meso and metathorax and caudal half of the abdomen below are pale in color.

Length 5-6 mm.

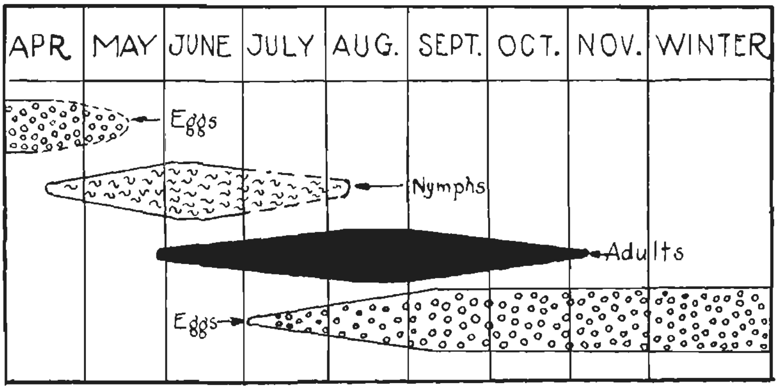


Figure 19. Diagram showing the length of the various stages in the life history.

Control Measures

Osborn suggests control measures for the grass-feeding spittle-bugs, which seem ample. Rotation of crops, or burning over grass land in the fall, winter or early spring should be effective. Hopper-dozer control would probably remove many of the adults but the latter are sluggish and it is doubtful whether the method would

capture a large per cent. Mowing in spring and fall unless very close to the ground and the grass raked off soon after, would also be ineffective because of the position of the eggs. If the grass is allowed to lie on the ground the nymphs will soon crawl from the cut grass to fresh stems.

Spraying is too costly an operation to be of much use in practical control work. Dusting might be done effectively under some conditions though it is well nigh impossible to get action from any insecticides owing to the protective spittle.

Summary

1. The grass-feeding frog-hopper may cause considerable damage to grasses in meadows.
2. The life cycle lasts a year, the greater part of which is passed as an egg laid during the summer and fall.
3. The eggs are laid between a leaf and a stem, being usually placed 4 or 5 together, and within two or three inches of the ground.
4. The adults are found in the field from June until frost, laying eggs over a considerable period (July-October).
5. The nymph passes through four stages, and lives about a month and a half. Nymphs hatched in 1921 about April 20.
6. Control measures should consist of burning over the land during fall, winter, or early spring.

Literature

1. Ball, E. D., Ann. Ent. Soc. Amer., XIII; 143; 1920.
2. Fernald, C. H., Mass. (Hatch) Exp. Sta. Bul. 12; 9–11; 1891.
3. Lintner, J. A., 4th Report of N. Y. State Entomologist 1887; p. 240–241.
4. Lintner, J. A., 5th Report of N. Y. State Entomologist 1888; p. 245.
5. Osborn, H., Maine Agr. Exp. Station, Bul. 254; 273–277; 1916.

Note:—This bulletin properly belongs in the report for 1921, but owing to delay in issuing the report for 1920, it is here included to secure its earlier publication.

CONNECTICUT

Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 231 — **SEPTEMBER, 1921**

Report of the

Tree Protection Examining Board

By W. E. BRITTON, *Chairman*

Miscellaneous Notes

By E. H. JENKINS

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In charge of the Tobacco Station.	G. H. Chapman, Ph.D., Windsor, Conn.

Press of The Wilson H. Lee Company.

FIRST REPORT

OF THE

Tree Protection Examining Board

FOR THE BIENNIAL PERIOD ENDING JUNE 30, 1921.*

By W. E. BRITTON, Chairman.

For many years men have traveled about the State and in various places obtained work for the alleged improvement of orchard and shade trees, such as pruning, spraying, bracing, filling cavities, or applying fertilizers. In some cases good service was rendered and the owners were satisfied; in others no benefit resulted. Occasionally trees were positively injured by the treatment, because the so-called "tree doctors" did not understand their business. Finally this condition existed: tree work was being done by well-trained, intelligent and conscientious men; by poorly trained but reliable men; and worst of all, by unscrupulous men who were usually, though not always, poorly trained. The unsatisfactory work of the unreliable men had a tendency to bring the whole business into disrepute. Some of them were at work here one day, but the next they would be gone, perhaps forever, only to be followed by a new crop. Even though such men guaranteed their work, the owner could obtain no redress because the men could not be found.

More than thirty years ago, in the southwestern corner of the State, traveling "tree doctors" did a flourishing business by boring holes in the trunks of elm trees and inserting some chemical substance which they claimed would dissolve in the sap and be carried to the leaves and keep the trees free from the attacks of the elm leaf beetle. The price was seventy-five cents per tree. It was easy money and many property owners "fell for it." Needless to state, no benefit followed the treatment, and members of the Station staff removed some of the material seven years after it was placed in the tree, and apparently none of it had dissolved. A chemical examination showed it to be powdered sulphur and some kind of grease, two substances as nearly insoluble in the sap as could easily be found.

Now such transient work damaged the business of those men and firms who had established a reputation for intelligence and

* This report properly belongs in the Station report for 1921 rather than in this Station report of 1920. But as there is great delay in issuing the latter it seems advisable to include in it this paper rather than to hold it for the Station report of 1921.

square dealing, and after due consideration, they thought best to apply for legislation to regulate this condition by the issuing of licenses or certificates to qualified workers.

As a result, the following act was passed by the General Assembly of 1919, and was approved May 2nd:—

AN ACT CONCERNING THE IMPROVEMENT, PROTECTION OR PRESERVATION OF FRUIT, SHADE OR ORNAMENTAL TREES.

Chapter 181. Public Acts of 1919. (In effect July 1, 1919.)

SECTION I. No person, firm or corporation shall advertise, solicit or contract to improve the condition of fruit, shade, forest or ornamental trees, by pruning, trimming or filling cavities, or to protect such trees from damage by insects or disease, either by spraying or any other method, without having secured a certificate as specified in section two of this act; and any person, firm or corporation failing to comply with the terms of this act shall be fined not more than one hundred dollars; provided any person may improve or protect any tree on his own premises or on the property of his employer or on any property within the limits of the town of which he is a legal resident, without securing such a certificate.

SEC. 2. The botanist, entomologist and forester of the Connecticut Agricultural Experiment Station shall constitute a board which shall, upon application from any person, firm or corporation, examine the qualifications of the applicant to improve, protect or preserve fruit, shade, ornamental or forest trees, and if satisfied that the applicant is qualified, may issue a certificate so stating; which certificate shall be valid for one year from the date of its issue, unless sooner revoked as provided in section three of this act, and may be renewed by the board for succeeding years without further examination, upon payment of the fee hereinafter required, provided any person, firm or corporation receiving such certificate shall be responsible for the acts of all employees in the performance of such work.

SEC. 3. Said board shall prepare all necessary forms and prescribe all rules and regulations governing examinations, and any certificate issued under the provisions of this act may be revoked by it upon proof that improper methods have been used or for other sufficient cause.

Sec. 4. Each applicant for an examination shall pay a fee of five dollars in advance, and a fee of two dollars, for each certificate or renewal issued; which fees may be expended by the board for any expense incurred by it in making examinations or issuing certificates, and an account of all receipts and expenditures under this act shall be rendered annually to the state comptroller.

As the botanist, entomologist, and forester of this Station were named to constitute a Board, a meeting of this Board was held on June 14th, and organized by electing as Chairman, W. E. Britton, Entomologist, and as Secretary and Treasurer, W. O. Filley, Forester. The Board also drew up the following rules and regulations according to the provisions of the law:—

EXAMINATION RULES AND REGULATIONS.

I. Each person, firm or corporation required to secure a certificate under Chapter 181, Public Acts of 1919, shall be examined as follows: When a firm is under control of one person who is solely responsible for the contracts, methods and oversight of each piece of work, this person

alone may be required to pass the examination, but when more than one person is responsible for the methods of work and oversight of same, each shall be required to take the examination. When foremen or others are given complete charge of recommending and applying treatments, they shall also be required to take the examination, in so far as it relates to their work. The Examining Board shall decide who shall be required to take the examination.

II. Unless otherwise arranged, candidates for certificates shall appear for examination at the Connecticut Agricultural Experiment Station, at New Haven, at such times as shall be designated by the Board.

III. Examinations may be oral, written, or both, as shall be determined by the Examining Board, and, in general, shall cover tree species, tree life and growth; diseases and insect pests of trees, with treatment for same; pruning and tree surgery.

IV. Candidates prior to the time of examination shall furnish a typewritten statement of their qualifications as follows:—

1. General education.
2. Special training for tree protection work.
3. Experience in tree protection work. The latter shall include
   (a) Place of business, name of firm and position now held.
   (b) Previous positions held.
   (c) Total length of experience.
   (d) Contracts now under way or completed during the past 12 months.

In addition three or more recommendations as to reliability and efficiency shall be furnished; and where typed or printed forms of contracts, regulations, etc., are used, these shall also be supplied, or if not available, statements shall be made concerning the same.

V. If satisfied with the qualifications of the applicant, the Board will issue a certificate good for the succeeding twelve months (unless revoked for cause), then to be renewed upon application under such conditions as the Examining Board may require in each case.

VI. Upon evidence of unfitness in training or improper business methods, the Examining Board may refuse to issue a certificate or cancel one that has been issued. Complaints may be made to the Board on these points, and if deemed desirable by the Board, private hearings of the interested parties shall be held.

The new measure became a law on May 2nd, but it did not take effect until July 1, 1919. In order to give the tree men a chance to meet the provisions of the law, two examinations were held before the law became operative: one on June 27th and one on June 30th. Four examinations were held in July, on the 9th, 12th, 16th and 23rd, respectively.

The form of application used is as follows:—

..............................19

I,..............................,hereby make application

to the Tree Protection Examining Board, for an examination / a renewal certificate, as provided in Chapter 181, Public Acts of 1919.

I enclose fee of $.............as required by law.

....
Applicant

....
Address

Fee for Examination Certificate; $5.00
" " Renewal Certificate $2.00

The law provides that the fee shall be paid in advance. In most cases a check for five dollars was received by mail, but in some cases the applicants were allowed to make payment at the time of the examination.

EXAMINATIONS

The Board expected and preferred to hold examinations rather infrequently and to have each one well attended. But though the new law and notices of the examinations were at first mentioned in the newspapers, only a few candidates were present at most of the examinations. Some of the applicants were unable to be present on any of the dates set and asked for another date in the near future. It often happened that an application would be received a few days following an examination, with a request for an examination at an early date. This explains the reason for holding so many examinations in attempting to accomodate the applicants.

During the two years covered by this report, twenty examinations were held on the dates given below:—

In 1919: June 27 and 30; July 9, 12, 16 and 23; August 1; September 7; October 29; November 19.
In 1920: January 28; March 17 and 31; May 5; June 7 and 17; September 15; December 6.
In 1921: February 28 and May 11.

The examination has consisted of written answers to certain fundamental questions, selected to show the applicants' knowledge of the subject. In addition to these answers, each applicant was asked oral questions by each member of the Board, and he was told whether his answers were right or wrong, and if wrong, wherein they were wrong. Several different sets of written questions have been used in the course of these examinations, and one of these is given below as a sample:—

TREE PROTECTION EXAMINING BOARD.

EXAMINATION QUESTIONS.

(Please indicate by number each question answered.)

A. **Injurious Insects** (Answer *both.*)

(1) Explain the purpose of an insecticide, name examples of the common types, and specify how they are used.

(2) Describe briefly the difference between sucking and chewing insects, explain how each may injure trees and give remedies for each.

(Answer *any two.*)

(3) What are the three principal types of insect injury to trees? Give an example of each with remedy.

(4) How and when would you treat elm trees as a protection against the ravages of the elm leaf beetle?

(5) What are the chief insect pests of the apple orchard, and what treatment is commonly recommended for each?

(6) Give a brief account of the maple borer and how to combat it.

B. **Tree Diseases.** (Answer *three out of the five.*)

(7) What are fungi? Give several examples. How do they reproduce? How does a parasite differ from a saprophyte?

(8) What kinds of injury to trees are caused by the following: Sun scorch? Drought? Ice storms? Late frosts? Lightning? Animals (including man)?

(9) What different fungous diseases have you tried to control and by what methods?

(10) What causes decay of wood in trees and how would you control it?

(11) What is a fungicide? Name four kinds. Give theory of spraying against fungi. How is Bordeaux mixture made? Distinguish between a fungicide and an insecticide.

C. **Tree Surgery.** (Answer *any three.*)

(12) Describe in detail the way you would remove a large limb and the treatment you would give the resulting cut surface if undecayed.

(13) Discuss the relative merits of filled cavities and open cavities, stating under what conditions you would recommend one or the other.

(14) Describe your method of filling cavities, giving the reason for each operation.

(15) What may be done to hasten the healing of wounds and the growing over of filled cavities?

(16) Discuss advantages and disadvantages of the different methods of strengthening weak trees

D. **Tree Life and Growth.** (Answer *one.*)

(17) Discuss the growth of a tree, indicating where and when growth takes place, also the manner in which the roots and leaves perform their work.

(18) Describe the way in which water and food materials are secured by a tree, and how they are utilized by it.

E. **Tree Species.**

(19) Identify the specimens on the table, giving the common name of each as numbered.

Altogether 65 candidates took the examinations. Of this number 61 were finally granted certificates, four of them being required to take a second examination. Four applicants were refused certificates because the Board did not consider them qualified.

Certificates

The form of the regular certificate adopted by the Board is as follows:—

CERTIFICATE

FROM

Tree Protection Examining Board

STATE OF CONNECTICUT

This is to Certify that ______________________________

of ______________________ has been duly examined in compliance with the provisions of Chapter 181, Public Acts of 1919, and is considered qualified to conduct the business of protecting trees.

No.	Entomologist, *Chairman*	Examining Board
Date	Forester, *Sec'y-Treas.*	
Expires	Botanist	

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONNECTICUT

A small card shown below was furnished for each foreman employed by a firm receiving a regular certificate:—

State of Connecticut

TREE PROTECTION EXAMINING BOARD

THE BEARER

is working under supervision of and is responsible to

....

of.............................Conn.,

to whom this board has issued Certificate No.........as provided by Chapter 181, Public Acts of 1919. Said Certificate expires.......................

CONNECTICUT AGRICULTURAL
EXPERIMENT STATION
NEW HAVEN, CONN.

....
Secretary

Up to this time no certificate has been revoked although several holders have failed to renew. The list of individuals and firms receiving certificates between July 1, 1919, and June 30, 1921, together with number and date of each certificate and date of renewal, is given below—

IST OF FIRMS AND INDIVIDUALS RECEIVING CERTIFICATES FOR TREE WORK.

Biennial Period Ending June 30, 1921.

Name	Address	Certificate Number	Date Issued	Date o Renewı
ıg, Edward H.	Branford, Ct.	34	Sept. 18, 1919	Not ren
, Thomas J., Jr.	Guilford, Ct.	21	July 16, 1919	July 15,
Co., F. A., Bartlett)	Stamford, Ct.	10	July 16, 1919	July 15,
ı & Saunders, / F. Beaupain)	So. Norwalk, Ct.	27	Aug. 13, 1919	Aug. 12,
Bros., st C. Bertolf)	Sound Beach, Ct.	24	July 30, 1919	July 29,
Edgar M.	Hartford, Ct.	52	June 7, 1920	June 6,
li, B. J.	Cromwell, Ct.	57	Mar. 1, 1921	
yllis S.	New Canaan, Ct.	20	July 16, 1919	July 15,
. A.	West Cheshire, Ct.	5	July 2, 1919	July 1,
Maurice L.	Lake Mahopac, N. Y.	46	Feb. 3, 1920	Feb. 2,
orestry Co., er S. Crosby)	West Haven, Ct.	29	Sept. 18, 1919	Sept. 17
mology, Conn. College, (S.P. er)	Storrs, Ct.	47	Mar. 22, 1920	Mar. 21
ree Expert Co.,	Kent, Ohio			
es T. Burks)	Stamford, Ct.	59	May 27, 1921	
J. Champlain)	Kent, Ohio	13	July 16, 1919	July 15,
H. Caldwell)	Kent, Ohio	15	July 16, 1919	July 15

Name	Address	Certificate Number	Date Issued
Desmond, Thomas H.	Simsbury, Ct.	50	April 5, 1920
Dunlop, Daniel S.	Cromwell, Ct.	58	March 1, 1921
Easton, Clifford H.	New York, N. Y.	53	June 17, 1920
Elm City Nursery Co., (W. E. Campbell)	New Haven, Ct.	7	July 2, 1919
Gavitt, Lester E.	Westerly, R. I.	51	May 10, 1920
Gilbert, J. E.	New Haven, Ct.	61	May 27, 1921
Goodwin Associates, The James L. (Edward E. Pettee)	Hartford, Ct.	38	Nov. 7, 1919
(James L. Goodwin)	Hartford, Ct.	39	Nov. 7, 1919
Hartford Forestry Co., (Philip Hansling, Jr.)	Hartford, Ct.	16	July 16, 1919
(Philip Hansling)	Hartford, Ct.	17	July 16, 1919
Herthal, Gus, Jr.	Bridgeport, Ct.	36	Sept. 18, 1919
Herthal, G. F.	Bridgeport, Ct.	25	July 30, 1919
Homewood Forestry Co., (Peter J. Belletti)	Waterbury, Ct.	41	Nov. 7, 1919
Hunt Co., W. W., (W. A. Wright)	Hartford, Ct.	33	Sept. 18, 1919
Jaynes, H. A., Conn. Tree Surgery Co.	Storrs, Ct.	56	Aug. 6, 1920
Kelley, James J.	New Canaan, Ct.	19	July 16, 1919
Kellner & Son, Herman H., (Arthur H. Kellner)	Danbury, Ct.	26	Aug. 13, 1919
Landscape Foresters Ltd., (C. F. Mager)	New York, N. Y.	32	Sept. 18, 1919
Mallett Co., George A., (George A. Mallett)	Bridgeport, Ct.	11	July 16, 1919
Markham, W. R.	Middletown, Ct.	23	July 30, 1919
McLain & Co., J. A., (J. A. McLain)	Stamford, Ct.	37	Sept. 18, 1919
McLeod, Donald	Cromwell, Ct.	54	June 17, 1920
Meader Co., L. H., (Lewis H. Meader, Jr.)	Providence, R. I.	31	Sept. 18, 1919
Millane Tree Expert Co., (Neil A. Millane)	Middletown, Ct.	1	July 2, 1919
Morris, Harry H.	Danbury, Ct.	40	Nov. 7, 1919
Munson Whitaker Co., (Robert O'Shea)	Boston, Mass.	42	Nov. 26, 1919
Nichol, James (Fred B. Bartlett)	Greenwich, Ct.	12	July 16, 1919
Old Colony Forestry Co., (Thos. J. McGinnis)	West Haven, Ct.	4	July 2, 1919
O'Meara, Harry J.	Stamford, Ct.	35	Sept. 18, 1919
Palmer, Arthur J.	West Haven, Ct.	2	July 2, 1919
Pauley Tree Expert Co., (George A. Pauley, Jr.)	New Canaan, Ct.	22	July 30, 1919
Quality Seed Store, (William J. Rice)	Stamford, Ct.	9	July 2, 1919
Rich, Nehemiah L.	Stamford, Ct.	3	July 2, 1919
Schoonman, W. J.	New London, Ct.	6	July 2, 1919
Shaw, Walter	Westville, Ct.	55	June 17, 1920
Sierman, C. H.	Hartford, Ct.	8	July 2, 1919
Smith, Joseph P.	Stamford, Ct.	44	Nov. 26, 1919
Van Heiningen, Jacob C.	So. Wilton, Ct.	48	April 5, 1920
Verkade, H.	New London, Ct.	18	July 16, 1919
Wilcox, Reginald C.	Essex, Ct.	30	Sept. 18, 1919
Wright, John J.	Putnam, Ct.	43	Nov. 26, 1919

TREE WORKERS' INSTITUTE

The early examinations indicated that many of the applicants were not well versed in the growth and care of trees, yet some of these men had conducted a fairly successful business for a number of years. Evidently they knew what to do better than they could tell how or why it should be done. To the members of the Board it seemed unfair to refuse certificates to such men, so an effort was made to help them by giving them the proper instruction in their work; consequently an institute was held at the Station on July 22 and 23, with the following program:-

TUESDAY MORNING, JULY 22

10:00 A. M.	How a Tree Lives and Grows (Illustrated). Prof. A. H. Graves.
11:00	Best Species of Shade Trees for Street and Home Planting. Best Methods of Planting and Guarding Street Trees. G. A. Cromie, Supt. of Trees, City of New Haven.
11:45	Discussion. Led by E. F. Coe, Elm City Nursery Co., New Haven.
12:00	Methods of Fertilizing Trees. Dr. E. H. Jenkins, Director, Conn. Agricultural Experiment Station.

TUESDAY AFTERNOON

2:00 P. M.	Fungous Diseases of Trees. (Illustrated by Stereopticon.) Dr. G. P. Clinton, Botanist.
3:00	Cavity Work and Care of Mutilations. G. A. Cromie, Supt. of Trees, City of New Haven.
3:30	The Pruning and Spraying of Shade Trees. G. H. Hollister, Supt. of Keney Park, Hartford.
4:00	Discussion. Led by F. A. Bartlett, Stamford.
4:15	Question Box.

TUESDAY EVENING

7:30 P. M.	The Tree Doctor and the Golden Rule. Dr. E. H. Jenkins.
8:15	Methods of Forest Planting and Management. (Illustrated by Stereopticon.) W. O. Filley, Forester.
9:00	Discussion. Led by L. F. Harvey, County Agricultural Agent, New Haven.
9:15	Question Box.

WEDNESDAY MORNING, JULY 23

10:00 A. M.	Some Common Insects Attacking Shade and Fruit Trees. (Illustrated by Stereopticon.) Dr. W. E. Britton, Entomologist.
11:00	The Pruning and Spraying of Fruit Trees. (Illustrated by Stereopticon.) E. M. Stoddard, Assistant Botanist.
11:30	Solid Stream Spraying as Practiced in Gipsy Moth Work. (Illustrated by Stereopticon.) I. W. Davis, Assistant Entomologist.
12:00	Discussion. Led by N. A. Millane, Middletown.
12:15	Question Box.

Notices of this institute were sent to newspapers and to all tree workers, including the tree wardens in each town and the men in charge of shade trees in each city in the State. Considering the

number of such men interested, the attendance was rather small, about forty being present. The rainy weather no doubt kept many away. The papers were full of interesting information and there was great interest shown by the questions and discussions.

At that time it was planned to hold further institutes but this has not been done, as the need for it has in part at least subsided. It was also thought best to form a State organization of tree workers and a committee was elected to prepare a plan, but so far nothing further has developed.

Financial Statement

Receipts

From 65 examination fees @ $5.00 each		$325.00
53 renewal fees @ $2.00 each		106.00
		$431.00

Expenditures

Printing	$59.70	
Postage	21.26	
Stationery	11.10	
Filing Cabinets, etc.	62.50	
Office Supplies	24.18	
Traveling Expenses of Board	38.28	217.02
Balance on Hand June 30, 1921		$213.98

Dangers Which May Arise

Of course tree workers are supposed to know all about trees and to be able to diagnose troubles on sight. Most of them are unable to do so, and many of our best specialists can do so only after a careful examination. Many times, evidence is lacking. If evidence can be obtained and the tree worker is in doubt, he should submit it to his Agricultural Experiment Station, or to some other institution where competent specialists are employed. There are many cases on record where tree workers have not done this, but induced the owners to allow them to give treatment at considerable expense, which afterward proved useless. Even positive injury has resulted in some instances. It is human nature for the tree worker to dislike to say that he does not know, yet an honest man frequently must do so. It is much better to say so and try to find out, than to make a serious mistake by giving the wrong treatment. There are many injuries to trees which are non-parasitic in their nature, for which the usual remedies for parasitic troubles are worthless.

Then, too, some owners give authority for certain work to be done, but do not keep in close touch with the progress of it and are astounded at the size of the bill when finally presented. A good way of keeping check on the cost is to have the owner or his agent approve and sign the time slips each day or week, as the case may be.

The Board may revoke a certificate for improper work done, or if dishonest business methods are followed when dealing with clients. The Board has no jurisdiction, however, over legal questions, such as fixing damages in a case of violation of contract. Such matters must go to the courts if they cannot be settled to the satisfaction of both parties.

Employ Workers Who Hold Certificates

Unless the owner is acquainted with some tree worker in whom he has confidence, it is safer to employ only those men or firms who hold certificates from this Board. It is true that the law permits a tree worker to practice without a certificate in the town of which he is a legal resident, but this provision was included for the purpose of allowing farmers and orchardists to employ men to do the necessary spraying and pruning of their orchards. It is a question if city tree workers should have been allowed to do this. However, the exception is clear in the law and must stand until changed.

If a tree worker solicits work from you, ask him if he or his firm has passed the examination and holds the certificate of this Board. If not, tell him that you prefer some one who holds a state certificate. This will help to induce all workers to apply for the examination and certificate, according to the provisions of the law. The names of those who have received certificates from the Board are given on pages 345 and 346.

Complaints Will be Investigated

The Board cannot guarantee the work of any one, even though a certificate has been issued to him, but requests that written complaints of unsatisfactory work, discourteous treatment, or improper business methods be filed with the Secretary. So far as may be possible, such complaints will be investigated and the findings will be recorded and furnished to both parties concerned. If the tree worker is at fault and the circumstances warrant, his certificate may be revoked.

The Board also invites complaints regarding tree workers who are operating in violation of the law, and will follow up all such complaints wherever feasible.

A Partial List of Publications Relating to the Care of Trees

Bailey, L. H., "The Pruning Manual," The Macmillan Co., New York, 1919.

Blakeslee, A. F., and Jarvis, C. D., "Trees in Winter," The Macmillan Co., York, 1913.

Collins, J. F., "Tree Surgery," Farmers' Bulletin No. 1178, U. S. Department of Agriculture, Washington, D. C., 1920.

Fernow, B. E., "The Care of Trees," Henry Holt & Co., New York, 1910.

Houser, J. S., "Destructive Insects Affecting Shade and Forest Trees," Bulletin 332, Agricultural Experiment Station, Wooster, Ohio, 1918.

Kotinsky, Jacob, "Insects Injürious to Deciduous Shade Trees and Their Control," Farmers' Bulletin No. 1169, U. S. Department of Agriculture, Washington, D. C., 1921.
Levison, J. J., "Studies of Trees," John Wiley & Sons, New York, 1914.
Peets, Elbert, "Practical Tree Repair," McBride, Nast & Co., New York, 1913.
Rankin, W. F., "Manual of Tree Diseases," The Macmillan Co., New York, 1918.
Solotaroff, William, "Shade Trees in Towns and Cities," John Wiley & Sons, New York, 1911.
Stone, G. E., "Shade Trees, Characteristics, Adaptation, Diseases and Care," Bulletin No. 170, Massachusetts Agricultural Experiment Station, Amherst, Mass., 1916.

Also, the bulletins and reports of this Station, and of other Agricultural Experiment Stations, and of the United States Department of Agriculture, treat of special subjects relating to trees. If available, these may be obtained free on request. It is recommended tha tree workers obtain these publications and use them for reference in connection with their work.

The foregoing report has been approved and adopted as the First Report of the Tree Protection Examining Board. It is *intended to issue future reports biennially covering the activities* of the Board under the provisions of the law.

Respectfully submitted,

W. E. Britton, Entomologist,
Chairman.

W. O. Filley, Forester,
Secretary and Treasurer.

G. P. Clinton, Botanist.

AN EXPERIMENT IN TOP-DRESSING A RUN-OUT MEADOW

By E. H. Jenkins

The meadow was acquired in 1915. Its previous cropping was unknown but its average annual yield for the following six years was 1.01 tons per acre of poor hay much mixed with weeds. Seventeen plots were established, 14 feet wide and 155½ feet long, each one-twentieth of an acre. Four-foot strips separated the plots. The top-dressings were applied early each year. The hay from all the plots was weighed on the same day. The yields of the checks show an increased natural yield from No. 1 to No. 17, and the "gains" have been corrected as required by this difference in the check plots. For two years no potash could be applied to plot 8, and in 1920 an equivalent amount of muriate was used in place of kainit.

The arrangement of the plots, their treatment and the corrected average results of the six years cropping appear in the following table

Fertilizer	Tons of Hay Per Acre	Corrected Gain in Tons	Cost of Fertilizer 1915	Cost Fertil 191
None	0.80	....	....	....
2.3 tons manure	1.57	0.56	$ 8.05	$12
250 lbs. nitrate	1.98	0.97	6.88	12.
175 lbs. nitrate + 150 lbs. bone	1.74	0.73	7.45	12
None	0.71	....	....	....
250 lbs. nitrate + 200 lbs. acid phosphate	1.96	0.96	8.18	15.
250 lbs. nitrate + 190 lbs. basic slag	2.05	1.04	8.49	'
250 lbs. nitrate + 200 lbs. acid phos. + 130 lbs. kainit	2.10	1.10	9.09	'
None	0.97	....	......	....
Double quantity of 2	1.69	0.68	16.10	25
" " " 3	2.09	1.08	13.76	25
" " " 4	1.47	0.46	14.90	25
None	1.01	....	......	....
Double quantity of No. 6	2.44	1.43	16.36	31.
" " " " 7	2.43	1.42	16.98	'
" " " " 8	3.19	2.13	18.18	'
None	1.10	....	......	....

sic slag and kainit were not available in 1919.

CERTIFICATION OF BABCOCK TEST APPARATUS

As provided by statute the Station tests the accuracy of Babcock apparatus which is used for determining the value of milk or cream. Each piece thus tested is permanently marked with the Station initials, CT. AG. ST. if it is accurately graduated: BAD if it is inaccurate.

Since our last report 2,102 pieces have been tested of which 43, or about two percent, were bad.

SORGHUM JUICE

A single test of juice from Early Amber Sorghum grown at Mt. Carmel gave the following result:

Sucrose (Cane sugar)	7.35%
Invert sugar	3.29
Total sugars	10.64
Undetermined solids	1.87
Total solids	12.51

TEST OF PERILLA

Perilla frutescens is grown extensively in Japan for the oil in its seeds. In 1917 the Institute of Industrial Research asked the co-operation of this Station in testing its growth in this part of the country.

The seed was planted in drills 18 inches apart about 3 inches apart in the row.

The planting was made May 31st, as weather and labor conditions made earlier planting impossible.

On September 18th, the plants had a maximum height of 50 inches, average 44-46 inches, and were beginning to blossom.

They were sparsely branched mostly near the root, and had already been slightly touched by frost. A short time later they were killed by cold.

We judge that, in this region, seed could only be produced by starting the plants in the greenhouse and later setting them in the field.

EFFECTS OF BORAX ON THE GROWTH OF POTATOES, CORN AND BEANS

By E. H. Jenkins

In consequence of the lack of German potash salts during the war, various domestic sources of potash were exploited and their output eagerly sought and used.

Occasional injury or total loss of crops led to careful search for the cause, which in widely separated districts was not at first evident. It was found that the domestic potash obtained from certain sources contained notable quantities of borax, which in relatively small amounts is a plant poison, and it was proved that in some cases the injuries noted were certainly caused by borax in the fertilizer. Further study of the poisonous effect of borax and the limits of its toxicity seemed to the directors of the New England, New York and New Jersey Stations to be immediately necessary, and it was evident that such a study could be carried

out best as a single joint project, each Station bearing its proportionate part of the expense involved. This Station joined with the others in this study.

Director Hills of the Vermont Station placed a suitable greenhouse at the disposal of the co-operating Stations, Director Woods and Dr. Morse, pathologist of the Maine Station, assembled the materials and prepared detailed plans, Director Lipman of the New Jersey Station selected a trained experimenter to take charge of the greenhouse work, and the experiments were carried out during 1920. The method and results were published in Soil Science Vol. XII, No. 2, pp 79-106, 13 plates August 1921, with the title, "Effect Upon the Growth of Potatoes, Corn and Beans Resulting from the Addition of Borax to the Fertilizers Used. J. P. Neller and W. J. Morse."

The general summary is as follows:

"Plants were uninjured where fertilizer mixtures made from borax-free chemicals were applied to soil in pots in which potatoes, corn and beans were grown. These crops were injured where the pots contained the same soil and the same fertilizer mixtures in like quantity, provided sufficient amounts of borax were added with the fertilizer. The same types of injury were produced, in somewhat greater degree, when a commercial fertilizer carrying equivalent amounts of borax was applied.

"Corn and beans were more susceptible to the injurious effects of borax than were potatoes. Under the conditions of the experiment, anhydrous borax at the rate of 3 pounds per acre was the largest amount that could be applied in drills with safety to beans. The limit for corn is somewhat under 5 pounds, and for potatoes slightly above 5 pounds per acre. Borax applied with the fertilizer below the seed or seedpiece proved more toxic in all cases than where applied above in like manner. Mixing the borax and fertilizer with the soil decreased the injury and slightly raised the amount that could be applied per acre with safety.

"Evidence was obtained that applications of lime prevented some of the injury to potatoes. The tests with gypsum and manure were not conclusive with this crop. All three of these materials seemed to reduce the toxic effects on corn. Lime was beneficial with beans, but gypsum and manure did not show any appreciable influence.

"The above results were all obtained with soil at an optimum water content of 19.2 per cent. A subsequent test with beans showed that more injury occurred where the soil moisture was maintained at 15.2 per cent. than where it was 30.4 per cent.

"The only indication of possible stimulation due to the presence of small amounts of boron occurred with corn, but the evidence was inconclusive."

The Station has a few reprints of this paper which can be given to persons specially interested in the technique followed.

TIMOTHY AS A COVER CROP FOR TOBACCO LAND

By E. H. Jenkins

Various experimenters have made observations on the amount of vegetable matter and plant food left in the soil by the stubble and roots of crops. Among these may be cited:

Heiden, Düngelehre, I, p. 72, 1866, and III, p. 243, 1872, notes the work of Boussingault, John, Schubart, Hellriegel, Dietrich and others.

Hopkins, Soil Fertility and Permanent Agriculture p. 218, 1910, gives statistics on the amount of dry matter and plant food in various legumes and cites the observations of others.

Penny, Delaware Station, Bulletin 67, 1905, reports observations on the root system of crimson clover at various periods of growth.

In the report of the Connecticut Board of Agriculture, 1871, p. 95, notice is given of Weiske's observations at Proskau, on the composition of roots and stubble of a number of crops. (Versuchs-St. 14, p. 107, 1871.)

Woods, Storrs Station Report, 1888, p. 28, reports Observations on the Quantity and Composition of Roots of Clover, Timothy, Wheat and Other Plants, taken at time of harvest in Maine.

The observations here to be noted do not admit of close comparison with those referred to above, for these reasons: They were made on young, green crops to be plowed under for manure. The sowing was somewhat heavier than would be practiced if the crop were to be harvested and it was grown on tobacco land, and therefore on very heavily fertilized soil.

The observations specially concern or only concern tobacco growers.

It is matter of common knowledge and common complaint among tobacco growers in the Connecticut valley that on many fields the yield of tobacco has gradually decreased.

No appreciable loss of quality in the leaf is noted but only an unsatisfactory yield per acre.

This cannot be attributed to lack of fertilizer for increased applications and changes in the fertilizer formulas have not improved this condition.

The cause of the trouble is not known and can only be surmised, but it has been noticed in some cases that resting the land by growing other crops for a few years restored the soil, so that the yield of tobacco became satisfactory again.

But this change of crops is both inconvenient and expensive. The tobacco grower usually specializes in the one crop.

His barns, tools and help cannot conveniently be shifted to the raising of other crops at any profit.

This condition has raised the question whether the restoration of the land cannot be effected gradually, if not immediately, by growing some kind of cover crop between successive tobacco crops, sowing the seed as soon as possible after harvesting tobacco and keeping the cover crop on the land until it has to be broken up in the spring and fitted for the next crop.

Several well-known growers have followed this plan consistently

some of which are reported in the Hartford County Farm News for August, 1919.

Various cover crops, have been suggested and tried. The nitrogen-gathering crops, vetches, clovers, soy beans and the like have no special value over the cereals on tobacco lands, because they do not exercise their nitrogen-gathering function where nitrogen is fairly abundant in the soil already, as is the case on highly fertilized tobacco fields.

There is the further objection to their use that certain legumes are natural hosts of the dreaded *Thielavia* or root rot disease; moreover they make no such growth through the colder season as do the cereals and other grasses.

Of these rye has been, and is, quite commonly used. The tradition that it sours the land has no basis in fact, but one sound objection to it is its very rapid growth in spring. If it is not turned under at just the right time it becomes too "woody" and when turned under decays but slowly and leaves the soil too loose and open. If rye is used it should be sown at the rate of a bushel and a half to the acre.

Timothy is now being tried and so far has given good satisfaction. It makes slow growth above ground and never gets too rank or woody before the time for plowing, but it forms a thick mat of very fine roots which fill the soil to the depth of six or eight inches and takes up from it surprisingly large amounts of plant food. It can be sown thicker than is usual in seeding down for a hay crop. Half a bushel of timothy seed per acre should be enough. It should be sown as early as is possible. Where tobacco is primed the seed may be sown after the second priming. Some wait until the tobacco is harvested and the stalk disk-harrowed.

We urge tobacco growers who are concerned with diminishing yields on their fields to test timothy as a cover crop for at least three years in succession, sowing early, with a fairly heavy seeding. It is the only alternative in sight to avoid the necessity of dropping tobacco and growing other crops for a time; and the experience of some growers has shown its value in restoring production.

Apart from the use of cover crops as a corrective for failing tobacco soils, they are always needed as a protection from the drifting of the soils in high winds, from their washing in heavy rains and from the leaching of the plant food in them. Whenever the land is unfrozen, timothy and rye are always growing and gathering and holding the soluble plant food in the soil for the following crop and adding to it a store of organic material got largely from the air.

Within the last two years some observations have been made by Mr. B. G. Southwick, the Hartford County Agent, Mr. Henry Dorsey, Extension Agronomist, and the writer, to determine how much organic matter and plant food a timothy cover crop might gather from a tobacco soil and hold for the tobacco crop.

The samples, usually five in each field, were taken with a six inch iron tube, driven down six or seven inches. The cores thus obtained with the roots and top growth, were very carefully washed out by the writer, on fine sieves, and when partially dried were cleaned as far as possible of all adhering soil and foreign matters and then analyzed.

While some roots go much deeper than seven inches their total weight is relatively very small.

The averages of the five samples taken from each field are given below.

A., B. and C. were taken May 8, 1919, just before the crop was turned under. The top growth was six to eight inches high. A from land of D. E. Newberry, South Windsor, B from Windsor Tobacco Corporation, Windsor, C from S. F. Brown, Poquonock.

D. E. F. were taken in the late fall of 1919 and show what had been taken by the crop before winter. D from J. W. Alsop, Avon, E from J. E. Phelps, Suffield F from D. E. Newberry, South Windsor.

G. and H. were taken in May, 1920, just before plowing. H is a mixture of timothy and alsike clover. In 1920 timothy did not make nearly as good a growth as in the previous year on account of unfavorable weather conditions and farmers generally did not have as good cover crops as usual.

The samples were taken from different fields, probably unlike in soil, moisture conditions and fertility, so that no very close agreement in results was to be expected.

But in general they indicate that *an even, thick stand of timothy may contain, when plowed under, not far from three tons of vegetable matter, 100 pounds of nitrogen, 50 of phosphoric acid and more than 100 pounds of potash for the use of the following crop.*

To fix a valuation on this material is hardly possible.

If we calculate that forty per cent. of the nitrogen is available to the coming crop and half of the phosphoric acid and potash, we find a valuation of about $31.00.

But the value of three tons of vegetable matter, quite widely and evenly distributed in the soil it is impossible to estimate.

POUNDS PER ACRE OF ORGANIC MATTER AND PLANT FOOD CONTAINED IN A COVER CROP OF TIMOTHY GROWN ON TOBACCO SOIL

	Organic Matter.	Nitrogen.	Phosphoric Acid.	Potash.
Spring, 1919				
A. So. Windsor,	7860	176	70	173
B. Windsor,	6099	185	75	183
C. Poquonock,	7112	160	72	150
Average	7020	173	72	168
Fall, 1919				
D. Avon	2813	68.2	31.5	61.2
E. Suffield,	2015	60.2	28.2	49.2
F. So. Windsor,	1398	39.4	17.8	28.3
Average	2075	55.9	25.8	46.2
Spring, 1920				

ERRATA.

Page 8, Last line, for Unbleached read Unleached.
12, Eighth line, for Foul read Fowl.
20, Fourth line from bottom, for Roger read Rogers.
40, Second line in table, for M. S. Shoemaker, read M. L. Shoemaker.
42, Sample 15031, for North. read Northern.
59, Second line following table, for potato, read pot.
142, 143, Top of 3rd column, for average, read acreage.
225, Twenty-third and twenty-ninth lines from top for glycerrizin read glycyrrhizin.
231, Tenth line from top, for cellusoses read celluloses.
282, Seventh line from bottom for adopted, read adapted.

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